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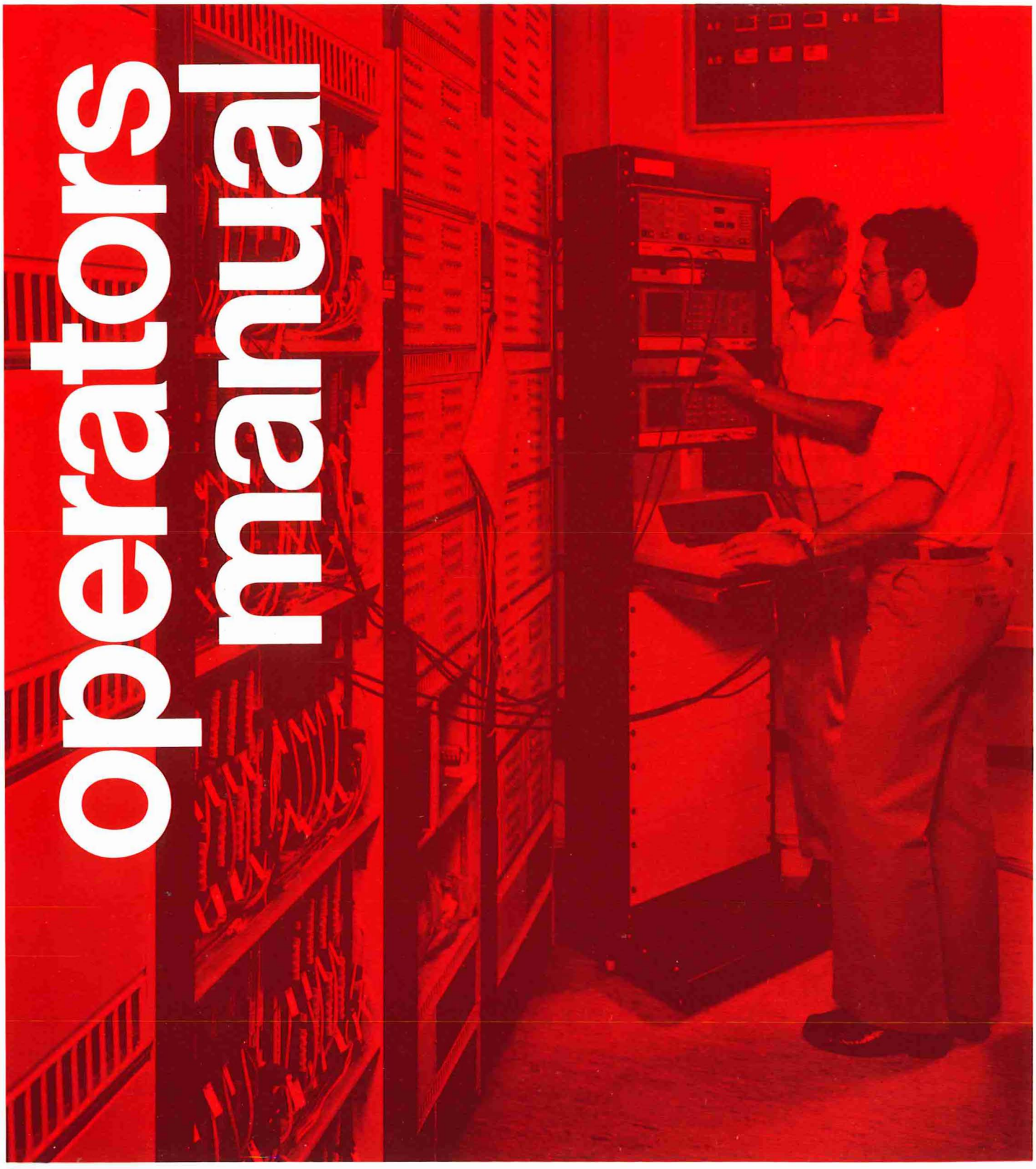
Reg 46

MFC Display ZTFK 76215

Telecom Test and Maintenance Equipment

operators manual



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MFC DISPLAY
ZTFK 76215

Operator's Manual

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NOTE: THE DESCRIPTION AND SPECIFICATIONS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE, BUT CIRCUIT AND COMPONENTS IMPROVEMENTS WILL BE INTRODUCED AS SOON AS THEY ARE AVAILABLE.

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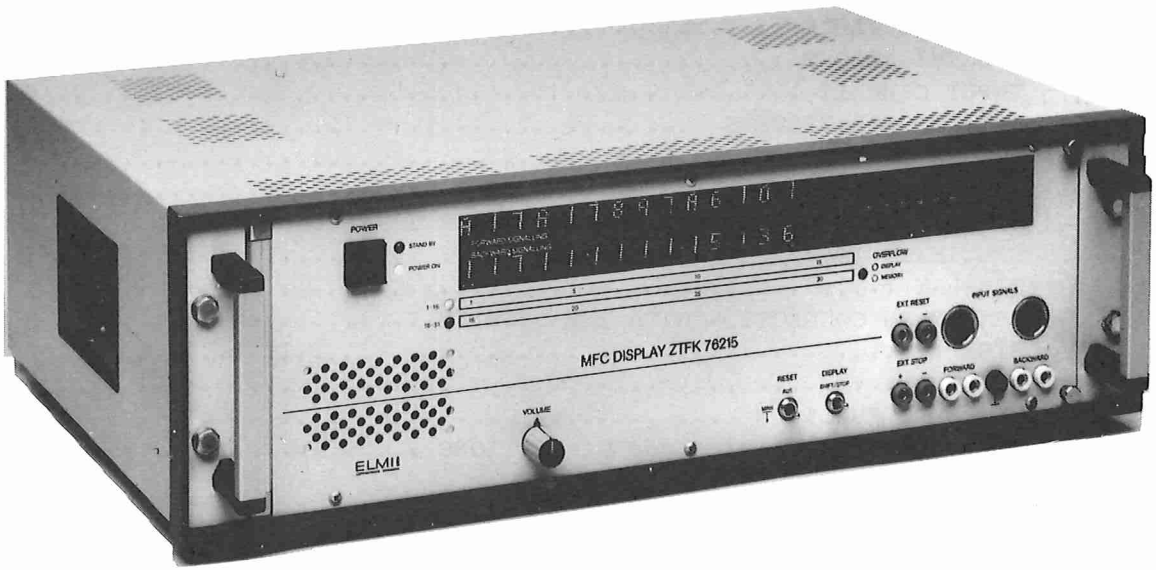
MFC DISPLAY ZTFK 76215
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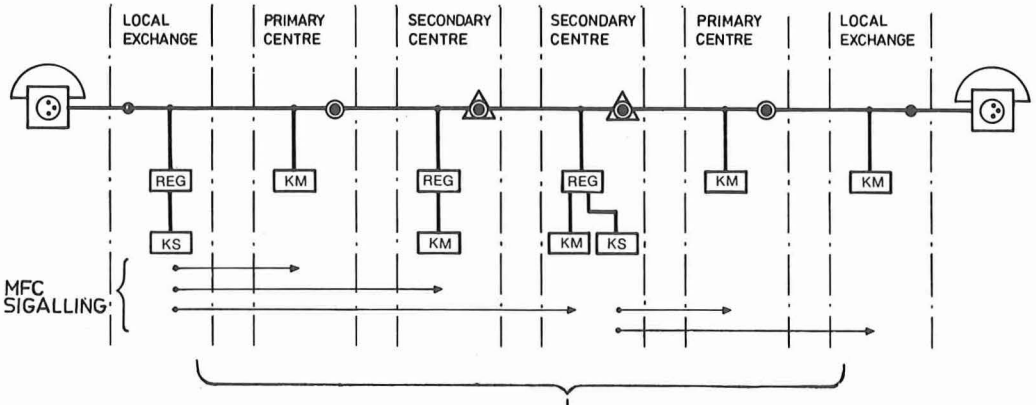
0. GENERAL INFORMATION

0.1 EXAMPLE



The MFC DISPLAY may be connected to the registers or to the lines, depending on the point where recording of MFC signalling is desired (not on CF links). Connection is made in parallel.

The MFC DISPLAY performs:
- a) Registration
- b) Decoding
- c) Displaying

} Of the recorded B-number as well as of control signals

The functions described under d) and e) are obtainable as options

The MFC DISPLAY transmits:
- d) Parallel output — This may be used for immediately recording of individual frequencies and their duration

e.g.

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ZTTK 10202
EVENT RECORDER

e) Serial output - for connection to

MODEM ⇒	Transmits the information in readable text to the central unit.
PRINT-OUT MEDIUM WITH V24 INTERFACE	Registers locally in readable text.
TAPE RECORDER WITH V24 INTERFACE	Registers locally and can later be connected to a MODEM/PRINTER

0.2 COMMON

The MFC DISPLAY ZTFK 76215 is a valuable tool for dynamic testing and recording of "MULTI-FREQUENCY-CODED-INTERREGISTER-SIGNALLING", used for establishing connection between exchanges.

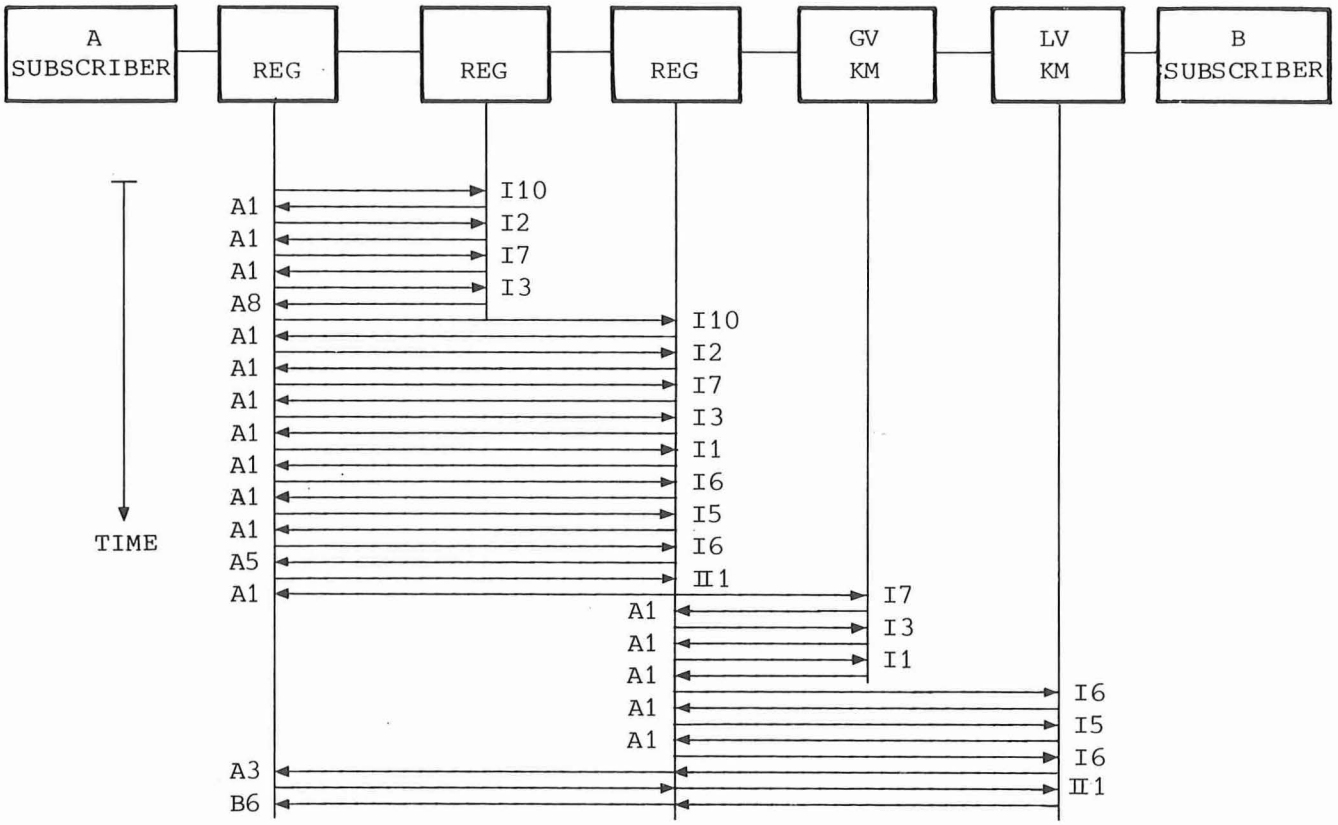
This system is recommended by CCITT as "SIGNALLING SYSTEM R2" and is specified in "THE GREEN BOOK", Vol. VI - 3, REC. Q 361-368 and "THE ORANGE BOOK", Vol VI - 3, REC. Q 440-480

In the example 0.1 the setting up of the connection is controlled by a register in the local exchange which has requested the connection. The register checks the connection in the area desired to be checked by sending numerical information in the shape of MFC signals to code receivers in the exchanges involved.

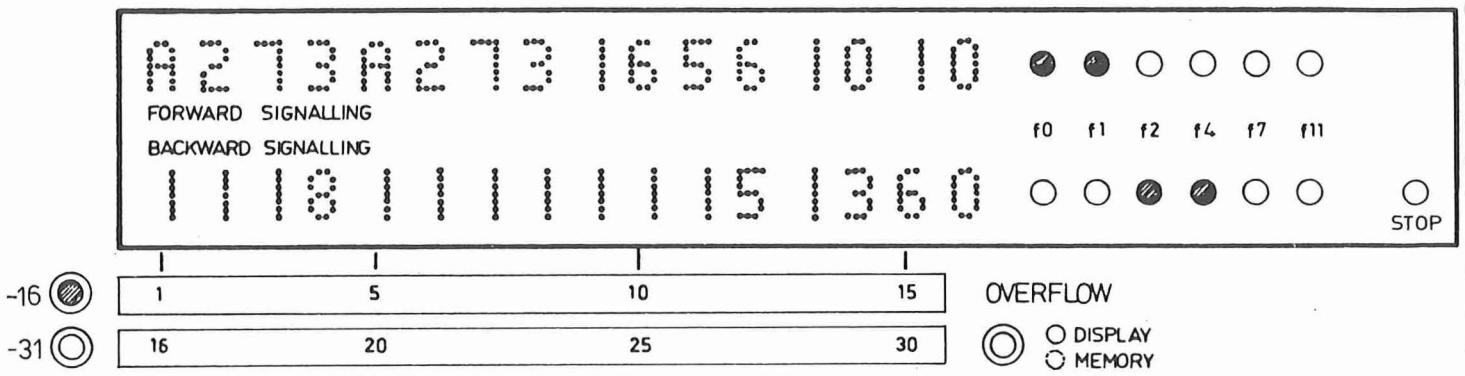
The local exchange requiring the connection might also have controlled the connection all the way to the receiving local exchange. However, as can be seen from the example another exchange may also take over the connection on the last half of the string.

0.3 EXAMPLE OF REGISTRATION OF CALL

Progress of call as a function of time. (Elapsed time plotted downwards).



The instrument will record the call as shown if it is connected to the register closest to the A-subscriber.



1. DESCRIPTION AND SPECIFICATION

1.1 DESCRIPTION

The instrument may be employed for 4-wire as well as 2-wire communication. For 4-wire communication the inputs are used separately in pairs, while they are connected in parallel for 2-wire communication.

This can be done because the instrument incorporates a directional filter.

As the signals are received and decoded, they are displayed by their hexadecimal numbers. (See the Decoding Table 1.2).

16 combinations may be displayed, but a built-in memory renders it possible to accommodate a further 15 combinations, which may be read out by activating the SHIFT switch. This yields a total of 31 combintations, both in forward and in backward direction; (the last digit from the first read-in is repeated as the first digit in the second read-in).

The first forward signal received will be displayed in the top row to the far left. At the same time the corresponding backward digit vill display a '0'. The answer to this forward signal (the backward signal) will be displayed directly below the forward one when it has been received and decoded. As the following signals are received and decoded, they will be read into the display on the first free space to the far left. When the call is ended, it is possible to shift between the two halves 1-16 and 16-31 as many times as is desirable. Two lamps below and to the left of the display field will now indicate the half being displayed.

In the right-hand side of the display there are six lamps to indicate the forward frequencies present at the input; there are in addition six lamps with corresponding information for backward frequencies.

The lamp information (the 2 x 6 lamps) is accessible in a connector on the rear of the instrument, so as to enable a tecorder to print out the frequency combinations during the call.

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1.2 DECODING TABLE

SIGNAL No.	THE DISPLAYED HEXADECIMAL CODE	BACKWARD FREQUENCIES (Hz)					
		f0 1140	f1 1020	f2 900	f4 780	f7 660	f11 540
1	1	X	X				
2	2	X		X			
3	3		X	X			
4	4	X			X		
5	5		X		X		
6	6			X	X		
7	7	X				X	
8	8		X			X	
9	9			X		X	
10	A				X	X	
11	B	X					X
12	C		X				X
13	D			X			X
14	E				X		X
15	F					X	X

SIGNAL No.	THE DISPLAYED HEXADECIMAL CODE	FORWARD FREQUENCIES (Hz)					
		f0 1380	f1 1500	f2 1620	f4 1740	f7 1860	f11 1980
1	1	X	X				
2	2	X		X			
3	3		X	X			
4	4	X			X		
5	5		X		X		
6	6			X	X		
7	7	X				X	
8	8		X			X	
9	9			X		X	
10	A				X	X	
11	B	X					X
12	C		X				X
13	D			X			X
14	E				X		X
15	F					X	X

HEXADECIMAL CODE: 0

This signifies that there have been no frequencies, or that the signal could not be decoded because there were one, three, four, five, or six frequencies present simultaneously.

At reset all display spaces are extinguished.

1.3 SPECIFICATIONS

1.3.1 INPUT CIRCUIT

The instrument has a balanced AC input.

The input impedance for
4-wire communication: Higher than 40 kΩ

The input impedance for
2-wire communication: Higher than 20 kΩ

Balance is better than
60 dB from 500 - 2000 Hz

Balance is better than
50 dB from 300 - 3400 Hz

1.3.2 DIRECTIONAL FILTERS

The instrument incorporates an LP filter for backward frequencies, and a HP filter for forward frequencies, enabling operation of the instrument on 2-wire communication.

1.3.3 SIGNAL PERCEPTION CRITERIA

Nominal frequencies

Backward: 540 Hz - 660 Hz - 780 Hz
900 Hz - 1020 Hz - 1140 Hz

Forward: 1380 Hz - 1500 Hz - 1620 Hz
1740 Hz - 1860 Hz - 1980 Hz

Frequency Deviation

from nominal value: $\pm$10 Hz

Voltage Level

referred to 0.775 V for each of the frequencies between -5 dB and -35 dB.

(Corresponding to the voltage at 0 dB generating 1 mW power in 600 Ohms).

Difference in Levels

of the two frequencies:

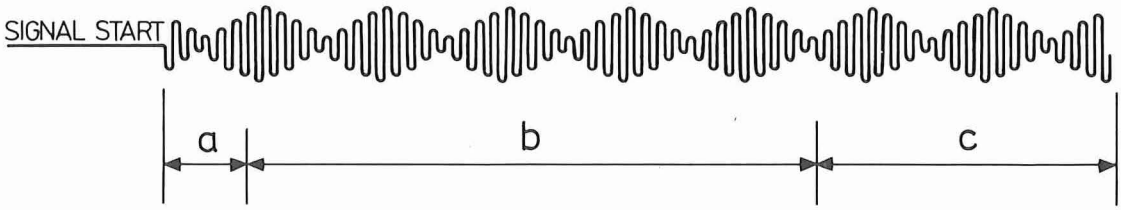
Max. 5 dB for adjacent frequencies

Max. 7 dB for non-adjacent frequencies

Signal and No-signal Duration

Duration of signal: Higher than 50 ms
No signal : Higher than 50 ms

1.3.4. SIGNAL PROCESSING IN TERMS OF TIME



The time a is the time elapsed before the instrument records the presence of a signal.

The time b is the time elapsing before the instrument starts processing the signal. (The signals must have a certain minimum length).

During the time c two, and only two, frequencies should be present for a certain period of time. If not, the instrument waits until this is so.

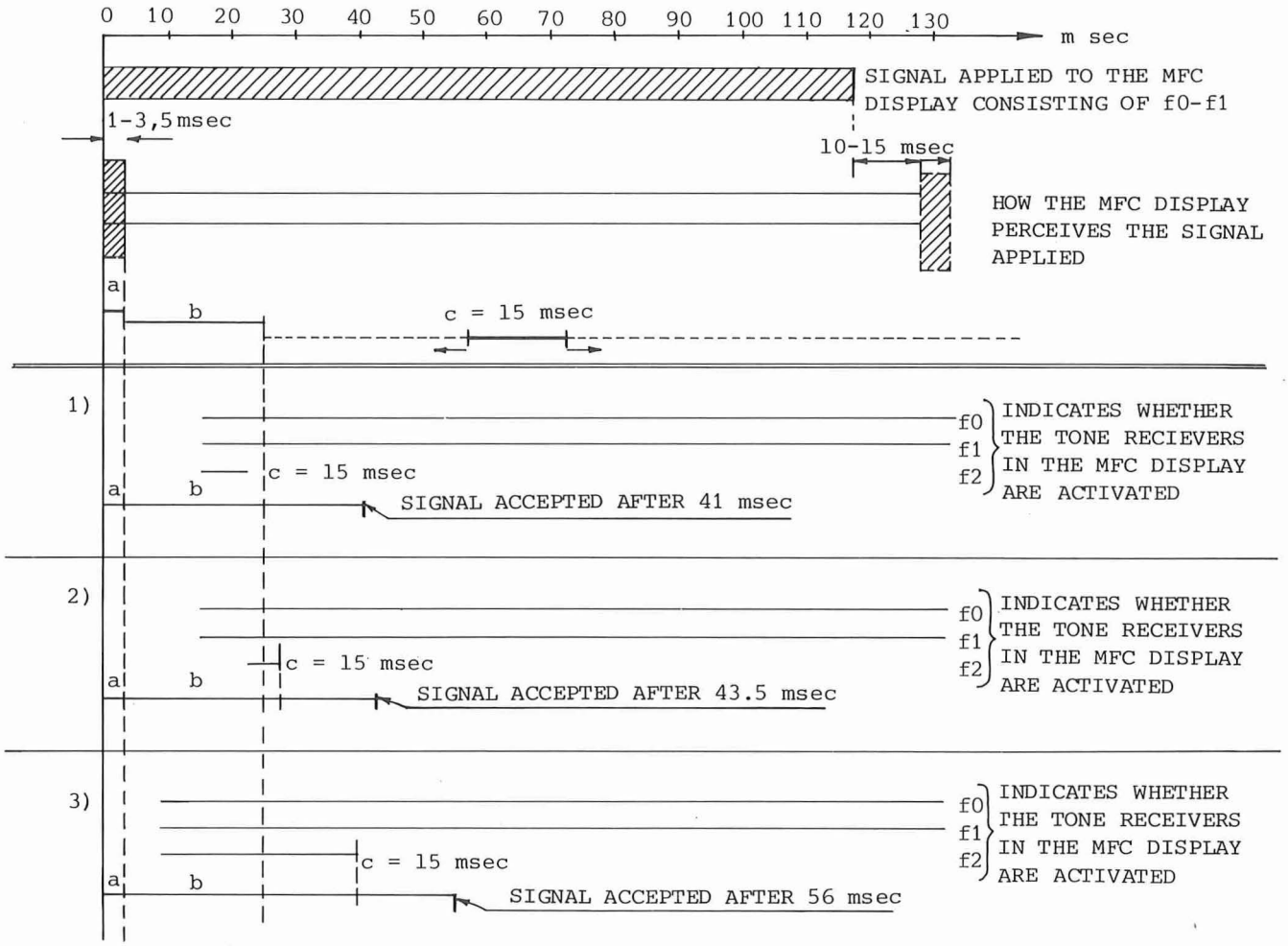
If the signal drops out while the instrument is waiting because there were 3 - 4 - 5 or 6 frequencies present simultaneously, the error lamp will start flashing.

Time a: between 1 and 3.5 ms
Time b: 22.5 ms
Time c: 15 ms

Giving a perception time of

38.5 - 41 ms if the signal is all right:

1.3.4.1 EXAMPLE OF THE CONNECTION BETWEEN THE TIMES OF APPROVAL SPECIFIED IN 1.3.3 and 1.3.4


0 10 20 30 40 50 60 70 80 90 100 110 120 130
m sec
SIGNAL APPLIED TO THE MFC DISPLAY CONSISTING OF f0-f1
1-3,5msec
10-15 msec
HOW THE MFC DISPLAY PERCEIVES THE SIGNAL APPLIED
a
b
c = 15 msec
1)
f0
f1
f2
INDICATES WHETHER THE TONE RECIEVERS IN THE MFC DISPLAY ARE ACTIVATED
c = 15 msec
SIGNAL ACCEPTED AFTER 41 msec
2)
INDICATES WHETHER THE TONE RECEIVERS IN THE MFC DISPLAY ARE ACTIVATED
c = 15 msec
SIGNAL ACCEPTED AFTER 43.5 msec
3)
INDICATES WHETHER THE TONE RECEIVERS IN THE MFC DISPLAY ARE ACTIVATED
c = 15 msec
SIGNAL ACCEPTED AFTER 56 msec

Re 1 It may be seen that f2 is activated for a short period of time, but this does not affect the decoding time, as it has occurred in the time interval b. The reason for f2 being activated may be various noise and intermodulation products.

Re 2) It may be seen that f2 is activated for a short period of time, and as it occurs in the time interval c, the result is a slighly longer time of acceptance. The reason for f2 being connected may be various noise and intermodulation products.

Re 3) It may be seen that f2 is activated for a short period of time, possibly on account of an error, but as the tone activated is deactivated again, the signal will nevertheless be accepted, but now after a considerably longer period of time.

CONCLUSION

From the above may be seen that a signal combination may be accepted after as little as 41 msec (The time from 1.3.4).

What is certain from 1.3.3. is however that if a pulse of 50 msec is applied, and difference of level and frequency deviation are kept, there will be sufficient time for decoding of the signal combination.

1.3.5 DISPLAY

The display can show 32 signal combinations simultaneously (16 forward and 16 backward signal combinations).

At reset the entire display is extinguished. When new digits are received, the displays light up (in pairs for forward and backward signals), as information is read out to them.

There are a further 6 lamps for forward frequencies, and 6 lamps for backward frequencies, which light up if the frequencies in question are present on the input of the instrument. The lamps are extinguished in the time a + b.

Furthermore, a stop lamp lights up if the instrument has gone into a stop condition.

1.3.6 MEMORY IN CONNECTION WITH THE DISPLAY

A built-in memory can store 31 decoded signal pairs (31 forward and 31 backward signals).

These are divided into two halves: 1-16 and 16-31, which can be read out on the display one after the other.

A lamp comes on when the 1-16 half has been read out, and flashes if at least one signal could not be decoded while these digits were read in since it contained too many frequencies.

A second lamp performs the same function for 16-31.

A third lamp lights up at the moment when the 17th digit is entered, which means that switching to the second half will be relevant since digits have also been received and decoded in this half. This lamp flashes when the 31st digit has been entered, which means that all further digits are lost.

1.3.7 STOP

STOP

When the instrument has STOPPED it means that it no longer responds to the MFC signals applied. A stop lamp indicates this condition. The information in the 2 x 6 lamps freezes. (Cf. also APPENDIX 5.2).

External Stop

After a condition corresponding to $V_{in} < 10$ V has prevailed for more than 10 ms, the condition $V_{in} > 24$ V in 10 ms causes the instrument to stop.

Maximum voltage: 70 V (continuous), 1000 V peak at average output = 0.5 W).

Manual Stop

The SHIFT switch also performs the function of causing the instrument to stop.

Automatic Stop Following Specific Digits Received

Depending on the setting of the switches, one of the following criteria has been selected:

a) Without delay after A6/B6 have been received.

b) Automatic disable of stop.

c) Without delay when A4/B4 have been received, or without delay when A15/B15 have been received, or if no backward signal is received, or if the signal cannot be decoded (corresponding to "A0"/"B0").

1.3.8 RESET

RESET

RESET is used for initializing the instrument. The display is extinguished, and a STOP condition is cancelled out (if applicable), and the instrument is ready for a read-in of the first digit in the first space (For further information, cf. Appendix 5.2).

POWER ON

Activating the power switch will reset the instrument.

EXTERNAL RESET

Depending on the setting of the switches, one of the following criteria have been selected:

a) After a condition corresponding to $V_{in} <$ 10 V has prevailed for more than 3 ms, the condition $V_{in} >$ 24 V for 3 ms will cause the signal processing to stop. The condition $V_{in} <$ 10 V will then have to prevail for 300 ms, after which resetting will take place.

b) After a condition corresponding to $V_{in} <$ 10 V has prevailed for more than 10 ms, the condition $V_{in} >$ 24 V for 10 ms will result in a resetting.

Maximum voltage: 70 V (continuous), (1000 V peak at an average effect = 0.5 W).

MANUAL RESET

Depending on switch setting, one of the following criteria have been selected:

a) Activating the switch for more than 3 ms will cause the signal processing to stop. Resetting will occur 300 ms after the switch has been released.

b) Resetting will occur 10 ms after the switch is activated. The switch will be ready for reactivation 10 ms after the switch has been released.

Automatic reset on specific digits with the reset switch in position AUT.:

Depending on switch setting one of the following criteria has been selected:

a) With a delay of 3000 ms after a backward digit has been received, provided that the preceding digit was A3/B3, or

With a delay of 3000 ms after the digits A4/B4 have been received, or

With a delay of 3000 ms after the digits A15/B15 have been received.

b) With a delay of 900 ms after a backward digit has been received, where the preceding digit was A3/B3, or

With a delay of 900 ms after the digits A6/B6 have been received.

c) With a delay of 900 ms after a backward digit has been received, where the preceding digit was A3/B3.

Automatic reset following specific events:

a) If the instrument has received more than 31 digits (overflow) and is not reset, it will be automatically reset after 5 sec.

b) If a shift is made between the two stop/reset modes, corresponding to SW 1-3 being shifted, resetting will be performed immediately.

1.3.9 WATCHDOG FUNCTION

If program execution does not take place as planned, the instrument incorporates a function which will automatically reset the instrument.

A lamp is provided on the rear of PCB P9; this lamp comes on if the watchdog function has been active, or if there has been a voltage failure condition. On account of the latter function, the lamp will always light up when the instrument is switched on. If the error information is not desired, it is not necessary to extinguish the lamp, as the watchdog function is nevertheless active.

The lamp can be extinguished by switch SW1-4.

1.3.10 VARIOUS NON-ELECTRICAL SPECIFICATIONS

1) Temperature range at drift

   $0^{o}C$ to $+45^{o}C$

2) Voltage supply

   110, 127, 220 or 240 V ($\pm$10%)

   Supply voltage frequency

   50-60 Hz

   Power consumption

   Approx. 25 VA

3) Dimensions

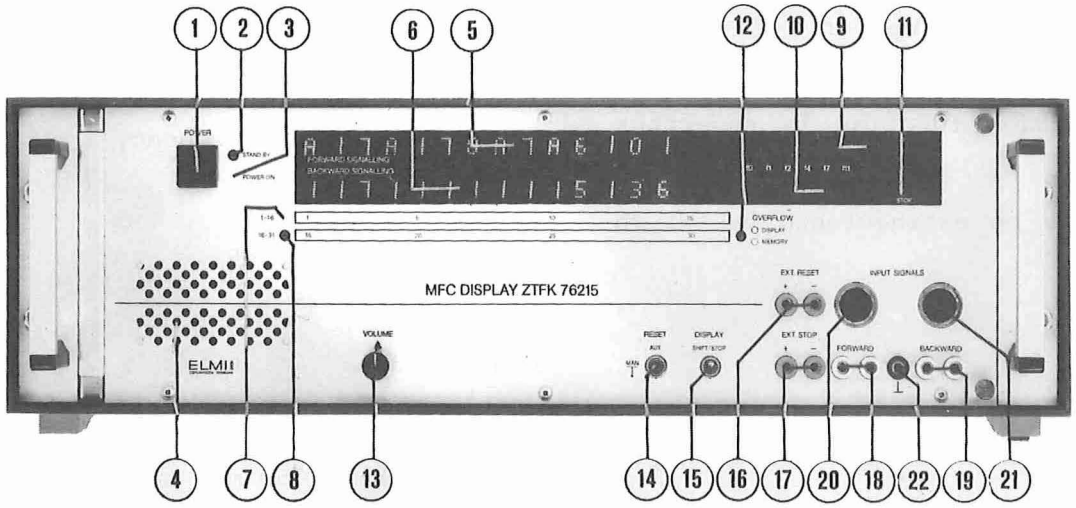
   Height: 150 mm
   Width: 500 mm
   Depth: 350 mm

4) Weight

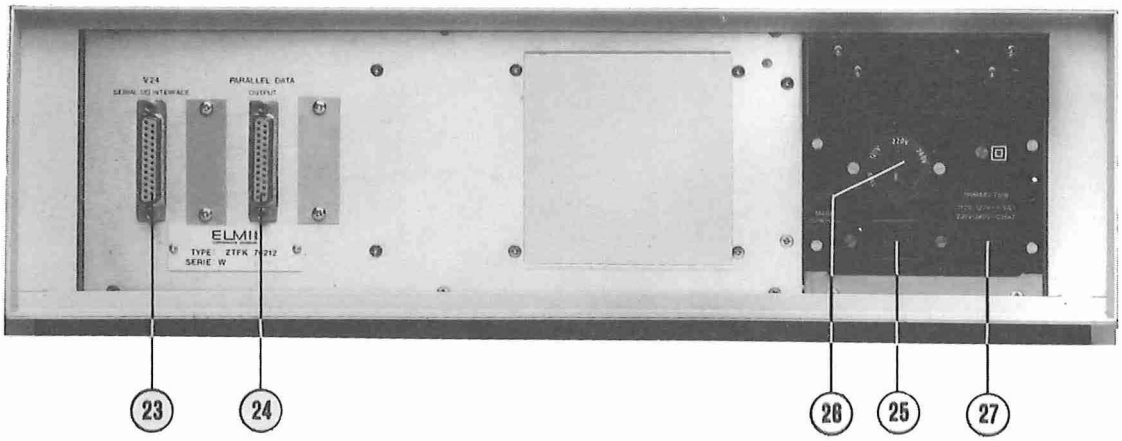
   Approx. 15 kg.

2. FUNCTIONAL DESCRIPTION

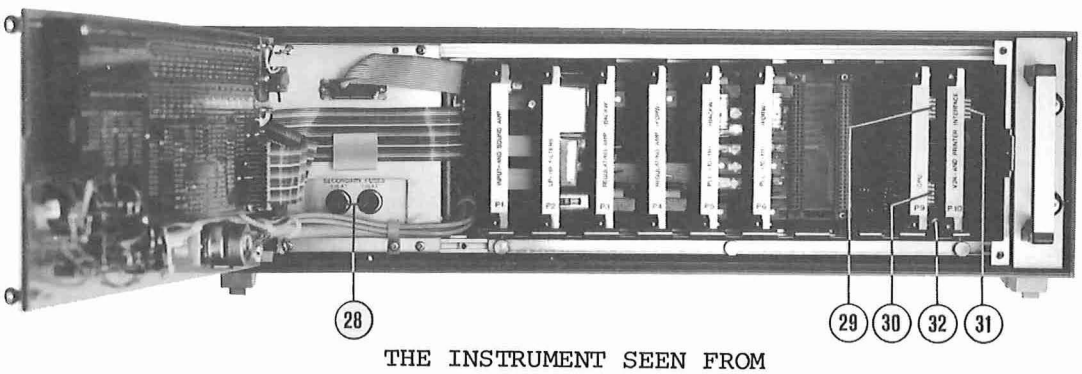
2.1 GENERAL VIEWS



THE INSTRUMENT SEEN FROM
THE FRONT



THE INSTRUMENT SEEN FROM
THE REAR



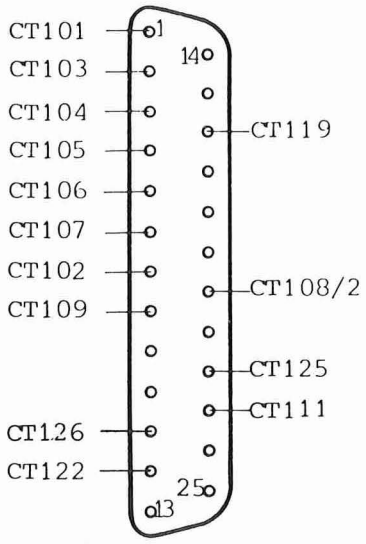
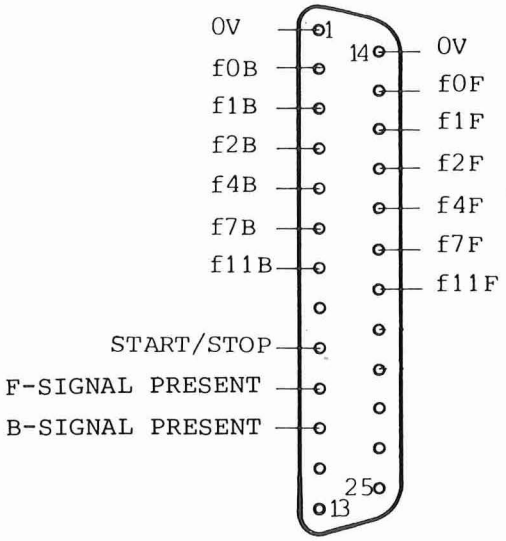
THE INSTRUMENT SEEN FROM
THE FRONT WITH OPEN FRONT PANEL

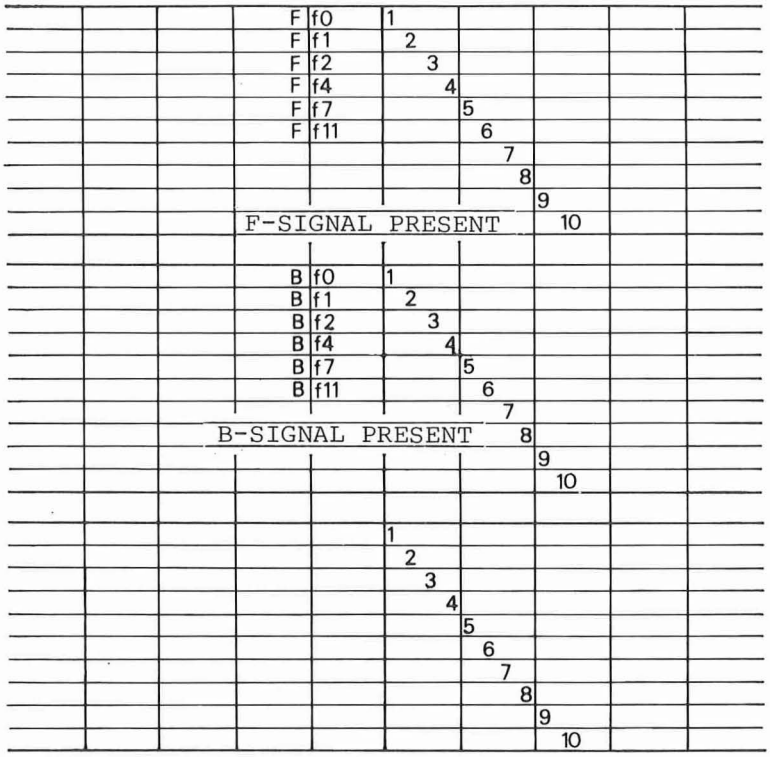
2.2 FRONT PANEL FUNCTIONS

(1)	POWER	Turns instrument on and off.
(2)	STAND-BY	If voltage is connected to the instrument, but has not been switched on by POWER SWITCH (1), this lamp comes on.
(3)	POWER ON LAMP	This lamp lights when the POWER SWITCH (1) is operated, at the same time as power is applied to the instrument.
(4)	SPEAKER	Speaker connected to built-in amplifier.
(5)	DISPLAY	Displays the decoded forward digits. If lamp (7) lights, the digits 1-16 are shown. If lamp (8) lights, digits 16-31 are shown. At reset the entire display is extinguished.
(6)	DISPLAY	As under (5) above, but for backward digits.
(7)	LAMP 1-16	The lamp lights if the display shows the digits 1-16. The lamp flashes if too many frequencies were present during the reading in of these digits, so that it was not possible to decode the signal in question.
(8)	LAMP 16-31	As (7) above, but for the digits 16-31.
(9)	LAMPS (f0-f11)	Each lamp represents a forward frequency. If one or more of these frequencies are present at the input of the instrument, the corresponding lamp(s) will light. There are 6 lamps f0-f1-f2-f4-f7-f11, which indicate the respective frequencies of 1380 - 1500 - 1620 - 1740 - 1860 - 1980 Hz.
(10)	LAMPS (f0-f11)	Each lamp represents a backward frequency. If one or more of these frequencies are present at the input of the instrument, the lamp(s) lights. There are 6 lamps f0-f1-f2-f4-f7-f11, which indicate the respective frequencies of 1140 - 1020 - 900 - 780 - 660 - 540 Hz.
(11)	LAMP (STOP)	This STOP lamp lights if the instrument is in STOP. This means that the instrument no longer records and decodes the applied signals.
(12)	LAMP (OVERFLOW)	This lamp lights if there is overflow in the display; the next approved digits are stored in the memory. If the lamp flashes it indicates that all signals applied from now on are lost, as there is overflow in the memory.
(13)	VOLUME	Controls volume of built-in amplifier.

(14)	RESET SWITCH	MAN. RESET: Resets the instrument when operated; the instrument is ready for a new call. AUT. RESET: Specific events/signal sequences will cause a reset function analogously with the one desribed under MAN. RESET.
(15)	DISPLAY SHIFT/ STOP	Operating this switch will cause a display of the signals 1-16 or 16-31; this will happen as often as the SWITCH is operated. At the same time the SWITCH incorporates a MANUAL STOP FUNCTION, as it causes the instrument to go into STOP MODE the first time it is operated.
(16)	EXTERNAL RESET	If a pulse above 24 V is applied to the jacks, the instrument will be reset and be ready for a new call.
(17)	EXTERNAL STOP	If a pulse above 24 V is applied to the jacks, the instrument will go into STOP mode.
(18)	FORWARD INPUT	Input jacks for forwards signals in 4-wire communication. For 2-wire communication the input jacks should be connected to the input jacks in (19), right to right, left to left.
(19)	BACKWARD INPUT	As (18) above with forward replaced by backward.
(20)	INPUT JACK	PINS 1 and 3 correspond with input jacks in (18). PIN 2 is 0V.
(21)	INPUT JACK	PINS 1 and 3 correspond with the input jacks of (19). PIN 2 is 0 V.
(22)	0 V	Instrument's 0 V.

2.3 REAR PANEL FUNCTIONS

(23)	V24 SERIAL I/O INTERFACE	V24 INTERFACE May only be used if option ZYYK 63337 is mounted  Connector seen from the outside
(24)	PARALLEL DATA OUTPUT	This output may be used in connection with ELMI's EVENT RECORDER, so that it is possible to have an indication of the duration of the signals and their positions in terms of time. The output can only be used if option ZYYK 633337 is mounted.  Connector seen from the outside

		When ELMI cable is employed the position of the signals will be as shown. 
(25)	MAINS CONNECTOR	
(26)	MAINS VOLTAGE SELECTOR	110 - 127 - 220 - 240 V AC
(27)	PRIMARY FUSE	Primary fuse 110 V and 127 V 0.5 AT 220 V and 240 V 0.25 AT

(28)	SECONDARY FUSES	Secondary fuses 2 x 3.15 AT

SMALL PCB-MOUNTED SWITCHES

(29)	SW1 (1-5)	The SWITCH is OPEN if it is away from the print, corresponding to the right when looking into the instrument from the front.
(30)	SW2 (1-5)	
(31)	SW3 (1-5)	The SWITCH is CLOSED if it is against the print, corresponding to the left when looking into the instrument from the front.

(29) FUNCTION SELECTION

SW1-1	Used in connection with option ZYYK 63337 in order to enable/disable transmission via the V24 interface. However, it is so that even if the option is not mounted, it is possible to select the STOP/RESET criteria which are used in the V24 transmission (cf. Appendix 5.2). OPEN: V24 enabled CLOSED: V24 disable
SW1-2	Used in connection with option ZYYK 63337 in order to select whether the transmission will take place with or without answer. OPEN: Transmission with ACK/NAK via V24 if enabled CLOSED: Transmission without ACK/NAK via V24 if it is enabled
SW1-3	Selects between various STOP/RESET criteria if V24 is disabled (cf. Appendix 5.2)
SW1-4	Used to extinguish the watchdog lamp OPEN: Neutral The function CLOSED - OPEN causes the lamp to extinguish
SW1-5	Selects between various STOP/RESET criteria (cf. Appendix 5.2).

(30) MODE SELECTION

	With closed switch the mode in question is selected (cf. also Appendix 5.1)
SW2-1	is connected to the processor but has no function
SW2-2:	the decoding time for backward frequency combinations containing f_{11} = 540 Hz is extended

	SW 2-3	No zeroes may be read out.
	SW 2-4	Even though there are frequencies present, it is considered to be a pause if the 6 tone receivers are all deactivatet.
	SW 2-5	Don't read out an approved backward signal before the forward signal disappears
	V24	
(31)	SW3-1	not connected
	SW3-2	selects between transmission with 1200 baud or 300 baud OPEN: Transmission with 1200 baud Called by means of the CT lines Transmission takes place by control bits CLOSED: Transmission with 300 baud (see SWITCH SW3-3)
	SW3-3	is enabled at SW3-2 CLOSED ~ 300 baud OPEN: Called by CT125 Transmission takes place with control characters CLOSED: Try to connect by it self Transmission without control characters
	SW3-4	is connected to the processor, but has no function
	SW3-5	is connected to the processor, but has no function
(32)	WATCHDOG LAMP	Lights at POWER ON or errors in program execution. Extinguished by SW1-4. (29)

3. OPTION ZYYK 63337/OUTPUT VIA THE V24 INTERFACE

3.1 INTRODUCTION

The instrument can be furnished with a V24/V28 interface against V23 or V21 modem for asynchronous data transmission.

Transmission may be performed at a speed of:

a) 300 baud simplex
b) 300 baud full duplex (answer at ACK/NAK)
c) 1200 baud simplex
d) 1200 baud simplex with backward channel for 75 baud (answer at ACK/NAK)
e) 1200 baud full duplex (answer at ACK/NAK)

If the instrument waits for ACK/NAK, and this is not received within 0.5 sec., it is considered as if an NAK has been received.

If characters different from ACK/NAK or characters with parity errors are received, it is considered as if no characters at all had been received.

If there is no answer to three subsequent blocks, this will cause the instrument to go into STOP (and to cut the connection).

If an NAK is received in a block, the block is transmitted once more; if another NAK is received, this is considered to be an ACK.

3.2 V24 INTERCHANGE CIRCUITS (CT LINES) USED

	PIN NO.	
CT 101	1	Cable shield
CT 102	7	Signal ground or common return
CT 103	2	Transmitted data
CT 104	3	Received data
CT 105	4	Request to send
CT 106	5	Ready for sending
CT 107	6	Data set ready
CT 108/2	20	Data terminal ready
CT 109	8	Data channel received line signal detector
CT 111	23	Data signalling rate selector
CT 119	16	Received backward channel data
CT 122	12	Backward channel received, line signal detecting
CT 125	22	Calling indicator
CT 126	11	Select transmit frequency

3.3 DATA WORD FRAME

Each data word consists of 10 bits, of which the data are standard ASCII characters.

Bit 1:	START Bit
Bit 2:	DATA Bit 1
Bit 3:	DATA Bit 2
Bit 4:	DATA Bit 3
Bit 5:	DATA Bit 4
Bit 6:	DATA Bit 5
Bit 7:	DATA Bit 6
Bit 8:	DATA Bit 7
Bit 9:	PARITY Bit, even parity
Bit 10:	STOP Bit

3.4 DATA VIA THE V24 INTERFACE

3.4.1 TRANSMISSION WITH CONTROL CHARACTERS

a) SW3-2 OPEN - 1200 baud
b) SW3-2 CLOSED at the same time as SW3-3 OPEN - 300 baud

STX	Start of text
RS	Separator
0/1	0: First transmission; 1: second transmission of the same block (received NAK or nothing at all)
RTY	Record type = 0
RBC	Record block count = 1
BLN	Block number = 1
BYC	Byte count (incl. STX ... ETX); this variable is a "dummy variable" which is set to "RS"
RS	Separator
"DATA"	The data block contains the registered call
ETX	End of text
BCC	Exlcusive-OR of 'STX' up to and including 'ETX'
BCC	Exclusive-OR of 'STX' up to and including 'ETX'
CR	Carriage return
CR	Carriage return
CR	Carriage return
LF	Line feed

STX	Start of text
RS	Separator
0/1	0: First transmission; 1: second transmission of the same block (received NAK or nothing at all)
RTY	Record type = 0
RBC	Record block count = 1
BLN	Block number = 1
BYC	Byte count (incl. STX ... ETX); this variable is a "dummy variable" which is set to "RS"
RS	Separator
"DATA"	The data block contains the registered call
ETX	End of text
BCC	Exlcusive-OR of 'STX' up to and including 'ETX'
BCC	Exclusive-OR of 'STX' up to and including 'ETX'
CR	Carriage return
CR	Carriage return
CR	Carriage return
LF	Line feed

⋮

etc.

3.4.2 TRANSMISSION WITHOUT CONTROL CHARACTERS - 300 BAUD

SW3-2 CLOSED at the same time as SW3-3 CLOSED

"DATA"	The data block contains the registered call
CR	Carriage return
LF	Line feed

"DATA"	The data block contains the registered call
CR	Carriage return
LF	Line feed

---

etc.

3.5 CONTENTS OF "DATA"

a) First forward digit
b) First backward digit
c) Second forward digit
d) Second backward digit
e) Third forward digit
f) Third backward digit
g) Fourth forward digit
h) Fourth backward digit
i) Fifth forward digit
j) Fifth backward digit

} SIGNIFICATION OF DIGITS see 1) or 2)

⋮

etc. - however, a maximum of 62 digits the digits can be:

1) Hexadecimal figure 1-F at 2-frequencies

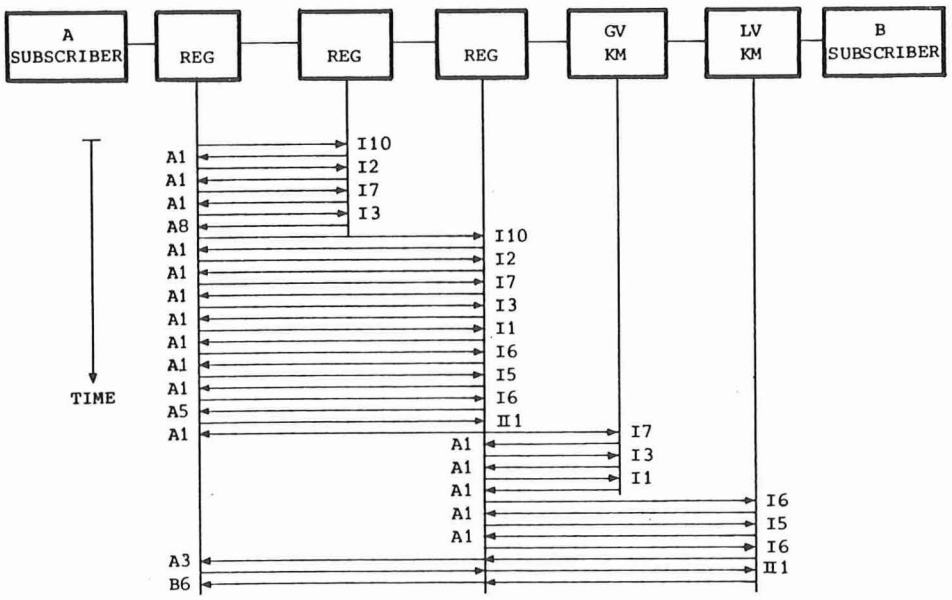
2) Possibly zero if it has not been possible to decode the combination, unless the code zero is not legal (cf. SW2-3)

The data block will be concluded on the following criteria, which all result in a resetting.

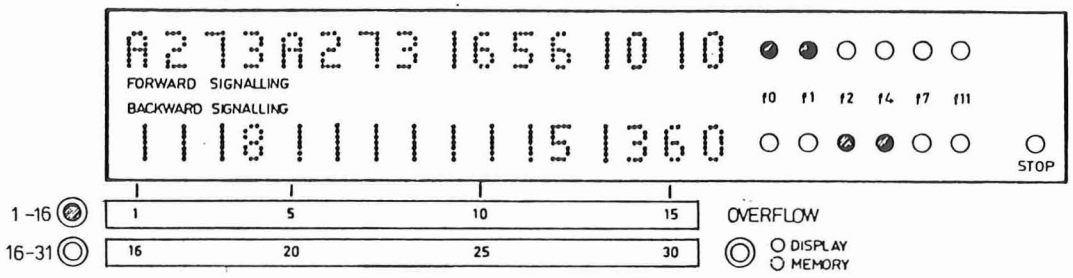
a) Up to (and including) the backward digit A4/B4/A15/B15, or
b) Up to (and including) a random backward digit, where the preceding backward digit was equal to A3/B3, or
c) Up to (and including the backward digit A6, if SW1-5 is OPEN, or
d) If 31 or more pairs of signals are received (overflow), or
e) If there is a manual or external reset.

3.6. EXAMPLE OF A DATA BLOCK

3.6.1. THE CALL



3.6.2. RECORDING



3.6.3. TRANSMISSION VIA V24

a) WITH CONTROL CHARACTERS

STX	RS	0	0	1	1	RS	RS		
A	1	2	1	7	1	3	8	A	1
2	1	7	1	3	1	1	1	6	1
5	1	6	5	1	1	0	3	1	6
ETX	BCC	BCC	CR	CR	CR	LF			

b) WITHOUT CONTROL CHARACTERS

A	1	2	1	7	1	3	8	A	1
2	1	7	1	3	1	1	1	6	1
5	1	6	5	1	1	0	3	1	6
CR	LF								

3.7 STOP AND RESET CRITERIA

3.7.1 STOP

When the instrument goes into a stop condition, the result is that it no longer responds to the MFC signals applied, at the same time as the connection via the V24 section is cut. The stop condition is displayed by a stop lamp.

The stop condition will be cancelled when the MAN. reset switch is operated, or when an external reset pulse is applied. Furthermore, a new transmission may be requested by setting CT 125 to ON, followed by either CT 122 or CT 109 , or by simply setting CT 122 or CT 109 to ON.

EXTERNAL STOP: After a condition corresponding to V_{in} < 10V has prevailed for more than 10 ms, the condition V_{in} > 24 V for 10 ms will cause the instrument to stop.

Maximum voltage: 70 V (continuous), (1000 V peak at an average output = 0.5 W).

MANUAL STOP: The SHIFT switch further performs the function of causing a stop; but when the V24 output has been enabled, this switch is disabled.

AUTOMATIC STOP on specific digits does not occur.

AUTOMATIC STOP on specific event during transmission:

a) If CT 106, CT 107, CT 122 or CT 109 go OFF. (CT 122 and CT 109 exclude each other in the sense that only the CT line which resulted in setting up the connection is monitored).

b) If ACK/NAK is not received on three blocks following each other when the transmission has been selected with ACK/NAK.

c) If V24 is selected, and a shift is made to non-selected, this will cause a stop.

3.7.2 RESET

Reset is used for initialization of the instrument, so that it is ready to receive a new MFC call.

After the respective CT lines in the V24 interface have been set to ON, so that the instrument is ready for transmission, the instrument waits for a reset to synchronize the MFC calls to the start of a call. The resets which are then made, are used as a seperating signal between the individual data blocks, and in addition the display itself will be reset.

EXTERNAL RESET: After a condition corresponding to V_{in} < 10 V has prevailed for more than 10 ms, the condition V_{in} >24 V in 10 ms will result in a reset.

Max. voltage: 70 V (continuous) (1000 V peak at an average output = 0.5 W).

MANUAL RESET: Resetting will performed by activating the switch.

AUTOMATIC RESET on specific digits by setting the reset switch to AUT.:

a) With a delay of 250 ms after the digits A4/B4 or A15/B15 have been received.

b) With a delay of 250 ms after a backward signal has been received, where the previous signal was A3/B3.

c) With a delay of 250 ms after the digit A6/B6 has been received. However, it is possible to disable this function.

AUTOMATIC RESET on specific events during the transmission:

If the instrument has received more than 31 digits (overflow) and is not reset in any other way, resetting will take place after 5 sec.

3.8 CONNECTION AND TRANSMISSION AT VARIOUS TRANSMISSION POSSIBILITIES

The ten transmission possibilities are selectable via the small switches, as well as depending on the CT lines which go ON and on the order in which this occurs.

For further details, cf. the section entitled "Introduction" (3.1), "Stop and Reset Criteria" (3.7), "Functions behind the Front Panel" (2.4), and "Survey of Transmission Possibilities" (3.8.2) for further information on transmission and criteria for connection and disconnection.

3.8.1 TRANSMISSION POSSIBILITIES

1. Connection by Call (switched)

SW3-2: OPEN

1200 baud simplex with backward channel for 75 baud with ACK/NAK

a) MFCD waits for CT 125 followed by CT 122 to go ON (CT 109 OFF)

b) CT 125 and CT 122 go ON

c) MFCD sets CT 105 and CT 108 ON, and CT 111 to 1200 baud

d) Wait until CT 106, CT 107 and CT 122 are all ON

e) Wait until RESET (external, manual or automatic)

f) MFCD transmits 1st block

g1) MFCD receives ACK

h1) MFCD transmits 2nd block

etc.

g2) MFCD receives NAK

h2) MFCD transmits 1st block

etc.

2. Fixed Connection (non-switched)

SW3-2: OPEN

1200 baud simplex with backward channel for 75 baud with ACK/NAK

a) MFCD waits until CT 122 goes ON (CT 125 and CT 109 OFF)

b) CT 122 goes ON

c) MFCD sets CT 105 and CT 108 to ON, and CT 111 to 12oo baud

d) Wait until CT 106, CT 107 and CT 122 are all ON

e) Wait for RESET (external, manual or automatic)

f) MFCD transmits 1st block

g1) MFCD receives ACK

h1) MFCD transmits 2nd block

etc.

g2) MFCD receivers NAK

h2) MFCD transmits 1st block

etc.

3. Connection at Call (switched)

SW3-2: OPEN

1200 baud simplex without ACK/NAK (with backward channel carrier)

a) MFCD waits for CT 125, followed by CT122, to go ON (CT 109 OFF)

b) CT 125 and CT 122 go ON

c) MFCD sets CT 105 and CT 108 ON and CT 111 to 12oo baud

d) Wait until CT 106, CT 107 and CT 122 are all ON

e) Wait for RESET (external, manual or automatic)

f) MFCD transmits 1st block

g) MFCD transmits 2nd block

etc.

4. Fixed Connection (non-switched)

SW3-2: OPEN

1200 baud simplex without ACK/NAK (with backward channel carrier)

a) MFCD waits for CT 122 to go ON (CT 125 and CT 109 OFF)

b) CT 122 goes ON

c) MFCD sets CT 105 and CT 108 to ON and CT 111 to 1200 baud

d) Wait until CT 106, CT 107 and CT 122 are all ON

e) Wait for RESET (external, manual or automatic)

f) MFCD transmits 1st block

g) MFCD transmits 2nd bolck

etc.

5. Fixed Connection (non-switched)

SW3-2: OPEN

1200 baud full duplex with ACK/NAK

a) MFCD waits for CT 109 to go ON (CT 125 and CT 122 OFF)

b) CT 109 go ON

c) MFCD sets CT 105 and CT 108 to ON and CT 111 to 1200 baud

d) wait until CT 106, CT 107 and CT 109 are all ON

e) Wait for RESET (external, manual or automatic)

f) MFCD transmits 1st block

g1) MFCD receives ACK

h1) MFCD transmits 2nd bolck

g2) MFCD receives NAK

h2) MFCD transmits 1st block

etc.

6. Fixed Connection (switched)

SW3-2: OPEN

1200 baud full duplex without ACK/NAK ("1200 baud simplex with CT 109")

a) MFCD waits for CT 109 to go ON (CT 125 and CT 122 OFF)

b) CT 109 goes ON

c) MFCD sets CT 105 and CT 108 to ON and sets CT 111 to 1200 baud

d) Wait until CT 106, CT 107 and CT 109 are all ON

e) Wait for RESET (external, manual or automatic)

f) MFCD transmits 1st block

g) MFCD transmits 2nd block

etc.

7. Connection at Call (switched)

SW3-2: CLOSED, SW3-3: OPEN

300 baud full duplex with ACK/NAK

a) MFCD waits for CT 125 to go ON

b) CT125 goes ON

c) MFCD sets CT 105 and CT 108 to ON and CT 126 to ON

d) Wait until CT 106, CT 107 and CT 109 are all ON

e) Wait for RESET (external, manual or automatic)

f) MFCD transmits 1st block

g1) MFCD receives ACK

h1) MFCD transmits 2nd block

etc.

g2) MFCD receives NAK

h2) MFCD transmits 1st bolck

etc.

8. Connection at Call (switched)

SW3-2: CLOSED, SW3-3: OPEN

300 baud full duplex without ACK/NAK

a) MFCD waits for CT 125 to go ON

b) CT 125 goes ON

c) MFCD sets CT 105 and CT 108 ON and CT 126 ON

d) Wait until CT 106, CT 107 and CT 109 are all ON

e) Wait for RESET (external, manual or automatic)

f) MFCD transmits 1st block

g) MFCD transmits 2nd block

etc.

9. Connection Prepared by MFCD

SW3-2: CLOSED, SW3-3: CLOSED

300 baud full duplex with ACK/NAK

a) MFCD sets CT 105 and CT 108 to ON and CT 126 to OFF

b) Wait for CT 106, CT 107 and CT 109 are all ON

c) Wait for RESET (external, manual or automatic)

d) MFCD transmits 1st block

e1) MFCD receives ACK

f2) MFCD transmits 2nd block

etc.

e2) MFCD receives NAK

f2) MFCD transmits 1st block

etc.

10. Connection Prepared by MFCD

SW3-2: CLOSED, SW3-3: CLOSED

300 baud full duplex without ACK/NAK

a) MFCD sets CT 105 and CT 108 to ON and CT 126 to OFF

b) Wait until CT 106, CT 107 and CT 109 are all ON

c) Wait for RESET (external, manual or automatic)

d) MFCD transmits 1st block

e) MFCD transmits 2nd bolck

etc.

3.8.2 SURVEY OF TRANSMISSION POSSIBILITIES

POSSIBILITIES	DATA TRANSMISSION	BAUD RATE	CHANNEL FOR ANSWER	CRITERION FOR CONNECTION	CRITERION FOR DISCONNECTION
1	SIMPLEX with ACK/NAK - WHEN CALLING (SWITCHED)	1200 BAUD/75 BAUD	CT 119	CT 125 - CT 122: ON	CT 106, CT 107 or CT 122: OFF, STOP condition, ACK/NAK missing on three subsequent blocks
2	SIMPLEX with ACK/NAK - FIXED CONNECTION (NON-SWITCHED)	1200 BAUD/75 BAUD	CT 119	CT 122: ON	CT 106, CT 107 or CT 122: OFF, STOP condition, ACK/NAK missing on three subsequent blocks
3	SIMPLEX w/o ACK/NAK - WHEN CALLING (SWITCHED)	1200 BAUD/ -	—	CT 125 - CT 122: ON	CT 106, CT 107 or CT 122: OFF, STOP condition
4	SIMPLEX w/o ACK/NAK - FIXED CONNECTION (NON-SWITCHED)	1200 BAUD/ -	—	CT 122: ON	CT 106, CT 107 or CT 122: OFF, STOP condition
5	FULL DUPLEX with ACK/NAK - FIXED CONNECTION (NON-SWITCHED)	1200 BAUD/1200 BAUD	CT 104	CT 109: ON	CT 106, CT 107 or CT 109: OFF, STOP condition ACK/NAK missing on 3 subsequent blocks
6	FULL DUPLEX w/o ACK/NAK - FIXED CONNECTION (NON SWITCHED)	1200 BAUD/ -	—	CT 109: ON	CT 106, CT 107 or CT 122: OFF, STOP condition
7	FULL DUPLEX with ACK/NAK - WHEN CALLING (SWITCHED)	300 BAUD/300 BAUD	CT 104	CT 125 - CT 109: ON	CT 106, CT 107 or CT 109: OFF, STOP CONDITION, ACK/NAK missing on 3 subsequent blocks
8	FULL DUPLEX w/o ACK/NAK - WHEN CALLING (SWITCHED)	300 BAUD/ -	—	CT 125 - CT 109: ON	CT 106, CT 107 or CT 109: OFF, STOP condition
9	FULL DUPLEX with ACK/NAK - FOR TERMINAL/ TAPE RECORDER	300 BAUD/300 BAUD	CT 104	CT 108/2-CT 105 ON & CT 126 OFF: WAIT FOR CT 106, CT 107, CT 109 ON	CT 106, CT 107 or CT 109: OFF, STOP condition, ACK/NAK missing on three subsequent blocks
10	FULL DUPLEX w/o ACK/NAK - FOR TERMINAL TAPERECORDER	300 BAUD/ -		CT 108/2-CT 105 ON & CT 126 OFF WAIT FOR: CT 106, CT 107, CT 109 ON	CT 106, CT 107 or CT 109: OFF, STOP condition
	Connection to local terminal or tape recorder is made by selecting between 1-10, at the same time as the real CT-lines are set to ON outside the MFC DISPLAY. This may also be done by correct connections in the connector.				

TABLE OF TRANSMISSIONS AND THE CT LINES EMPLOYED

POSSIBILITIES	CT 102	CT 103	CT 104	CT 105	CT 106	CT 107	CT 108	CT 109	CT 111	CT 119	CT 122	CT 125	CT 126
1	X	X		X	X	X	X		X	X	X	X	
2	X	X		X	X	X	X		X	X	X		
3	X	X		X	X	X	X		X		X	X	
4	X	X		X	X	X	X		X		X		
5	X	X	X	X	X	X	X	X	X				
6	X	X		X	X	X	X	X	X				
7	X	X	X	X	X	X	X	X				X	X
8	X	X		X	X	X	X	X				X	X
9	X	X	X	X	X	X	X	X					X
10	X	X		X	X	X	X	X					X

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3.8.3 TIME CRITERIA FOR CONNECTION

Modes 1 and 3

If CT 125 goes ON, and neither CT 109 nor CT 122 go ON within 30 sec., the fact that CT 125 went ON is disregarded.

Modes 1, 2, 3, 4, 5, and 6

After CT 109 or CT 122 have gone ON, the instrument waits for 30 sec. to see that both CT 106 and CT 107 go ON. If this does not happen, the result will be disconnection and stop.

Modes 7 and 8

If CT 125 goes ON, the instrument waits for 30 sec. to see whether CT 106, CT 107 and CT 109 go ON. If this is not the case, the result will be disconnection and stop.

Modes 9 and 10

After CT 105 and CT 108 have been set to ON, the instrument waits until both CT 106, CT 107 and CT 109 go ON.

3.8.4 CRITERION FOR DISCONNECTION FOLLOWED BY CONNECTION

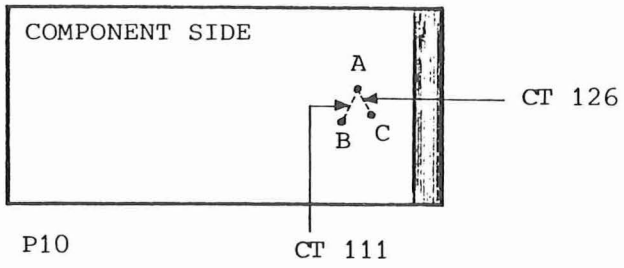
At disconnection, the instrument waits for CT 106, CT 107 and (CT 109 or CT 122) to go OFF. If this does not happen, connection cannot be performed via the V24 interface, but exclusively by a reset function.

3.8.5 SELECTION OF BAUD RATE

The baud speed must be selected before the instrument is switched on.

When supplied from ELMI, the instrument is ready for transmission with 1200 baud, and CT 111 operates in accordance therewith.

If transmission is performed at a speed of 300 baud, this is simply set by the switches. However, if CT 126 is also to act in accordance with the diagrams, it is necessary to move the strap mounted between A and B on the P10 - V24/PRINTER INTERFACE print, to the points A and C.



4. OPTION ZYYK 63337/OUTPUT TO THE EVENT RECORDER

4.1 GENERAL ASPECTS CONCERNING THE OUTPUT

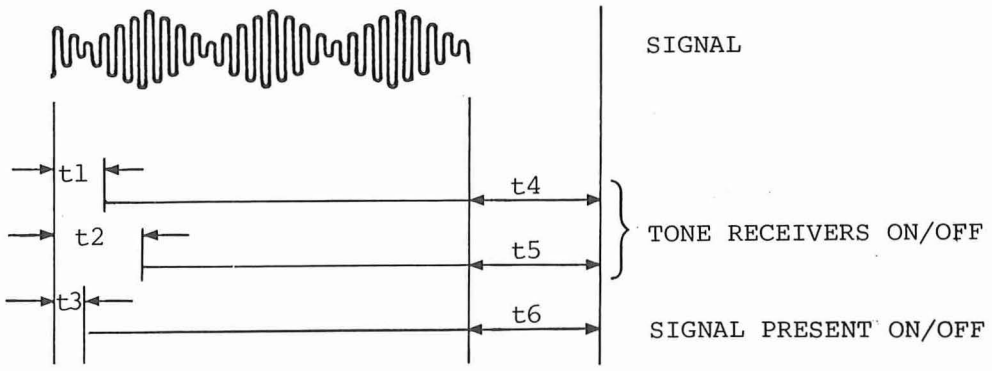
A connector is provided on the rear of the instrument, from which the information from the input terminals is available, decoded in the same form as for the 2 x 6 lamps. Furthermore, there are two signals, one for the forward input and one for the backward. These inputs indicate whether there is a signal on the inputs, no matter whether it is noise, MFC signals or random frequencies. The signals become active if the applied signal complies with the demand for the minimum level.

In order to start and stop the Event Recorder, depending on whether a call starts or stops, a start/stop signal is provided. In order to prevent the Event Recorder from being activated at small noise signals, the start/stop signal does not become active until 22.5 ms after a continuos signal has been applied. By using ELMI A/S' Event Recorder, furnished with delay unit, the first 22.5 ms will nevertheless be printed out, as the delay unit gives a delay of 256 ms on the signals, while the start signal is only delayed for 60 ms (until the motor is running at full speed).

At stop or reset the start/stop signal goes back to stop.

The Event Recorder print-out gives a fair indication of the inter-position and duration of the signals. Distortion is shown by the example in 4.2 below.

4.2 DISTORTION OF THE EVENT RECORDER PRINT-OUT



$t_1 = t_2$: 5-20 ms
t_3 : 1-3.5 ms
$t_4 = t_5 = t_6$: 10-15 ms

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5. APPENDIX

5.1 SWITCH GROUP SW2, 1-5

Together these switches provide for different modes, each of which is characterized by the way in which pauses, pulses, etc. are processed. The possibilities have proved useful on account of intermodulation products and "other noise".

Each switch selects a specific mode, and the user may then decide how many modes are to be active at the same time.

The mode in question is selected if the switch is CLOSED.

MODE	I	II	III	IV	V
SW2-1	-	-	-	-	-
SW2-2	0	0	0	0	X
SW2-3	0	0	0	X	0
SW2-4	0	0	X	0	0
SW2-5	0	X	0	0	0

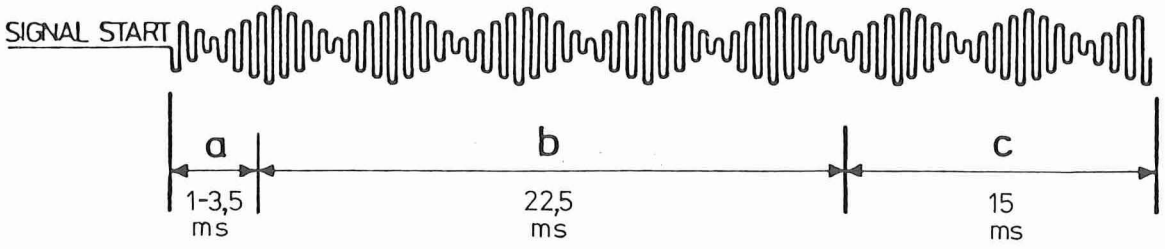
0 = SWITCH 'OPEN'

X = SWITCH CLOSED

5.1.1 I-MODE

Time of approval: 38.5 ms - 41 ms if the signals are all right

Signal processing in terms of time:



The time 'a' is the time elapsed before the instrument detects that a signal is present.

Small signal dropouts will be accepted in the time 'b' in the way that the time 'b' will be equal to 22.5 ms plus the sum of all small dropouts.

In the time interval 'c' two, and only two, frequencies should be present. If not, the instrument waits until this is the case. If one or both frequencies drop out, or if more frequencies are added while the instrument is in the interval 'c', the result will be that a new period of 15 ms must be run through when only two frequencies are present again.

This indicates that only 'two-out-of-six' tone combinations of a certain duration will be accepted.

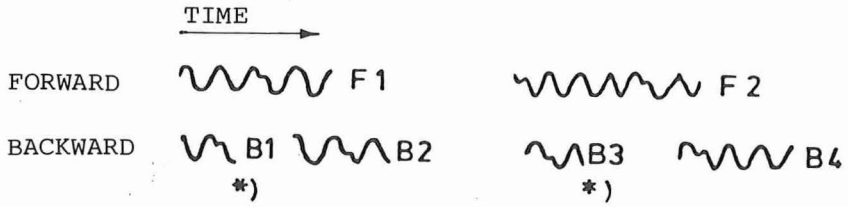
The fault lamp will flash if it has not been possible to decode the signal as three, four, five or six frequencies were present. However, this function will not be activated until the first pair of digits has been approved and read out.

The interval between signal pairs (the time elapsing from the end of the backward signal to the beginning of the next forward signal) is of no significance. It is solely the time between the forward signals and the time between the backward signals which is important.

5.1.2 II-MODE

This mode works as the I-mode described above, but with the following modification:

As long as a forward signal is present, the decoding of the backward signal will take place, and each time a signal is accepted it is stored without being displayed. When the forward signal disappears, the last decoded and accepted backward signal will be displayed. When the forward signal disappears, the last decoded and approved backward signal will be read out. In case of reset before the last forward signal disappears, the last accepted backward signal will be routed via V24 if transmission is active.



THIS WILL BE DISPLAYED AS

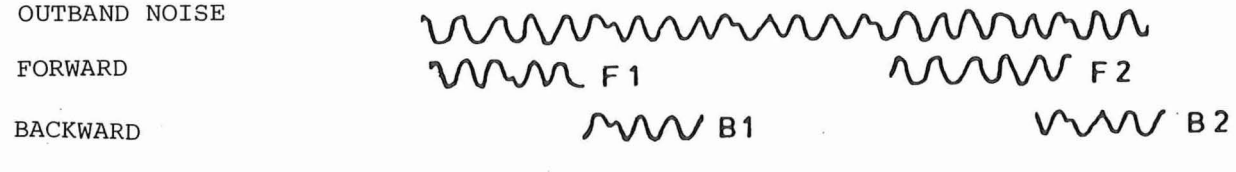
F1	F2
B2	B4

*) Not signals but noise.

5.1.3 III-MODE

This mode, also, works as the above-mentioned I-mode, but with the following modification.

Even if an outband signal (i.e., a forward or a backward signal outside the MFC R2 frequency range) is present together with the real MFC R2 signal, as well as in the pause between two signals, the instrument will still decode and read out the MFC R2 signals.



THIS WILL BE DISPLAYED AS

F1	F2
B1	B2

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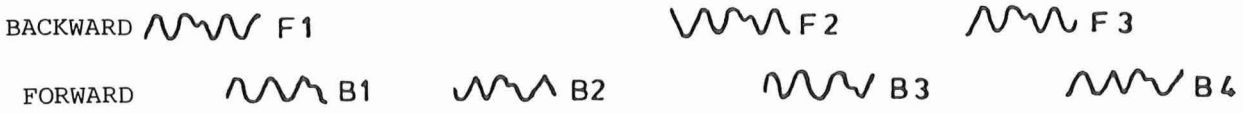
5.1.4 IV-MODE

This mode, also, works as the above-mentioned I-Mode, but with the following modification.

No digits are allowed to be missing, neither backward (so far indicated by a '0') nor forward.

When a forward digit is missing, the next forward digit will be shown in the empty position, while the corresponding backward digit will be omitted.

The opposite will happen when a backward digit is missing.



THIS WILL BE DISPLAYED AS:

F1	F2	F3
B1	B2	B4

(Here a forward signal is missing)

5.1.5 V-MODE

This mode, also, works as the above-mentioned I-Mode, but with the following modification.

If the backward signal comprises the frequency 540 Hz (f11), the decoding time 'c' will be increased to 30 ms as regards the digits B, C, D, E, F.

5.2 RESET/STOP FUNCTIONS

1) General

Reset is used for initializing the instrument, so that it is ready to receive a new MFC call.

2) At transmission via the V24 section

After the respective CT lines in the V24 section have been set to ON, so that the instrument is ready for transmission, the instrument waits for a reset in order to synchronize the MFC calls to the start of a call. The subsequent resets will be used as partitioning signals between the individual data blocks, and in addition the display proper will be reset.

STOP FUNCTION

When the instrument goes in stop, this causes it to no longer react to the MFC signals applied.

A stop lamp indicates that the instrument has gone into a STOP condition.

One of the following things will have to occur in order to cancel the STOP condition:

1) The V24 print is not mounted, or the V24 function has not been selected.

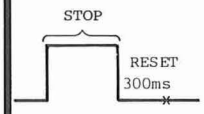
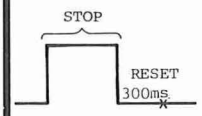
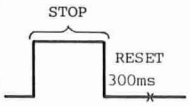
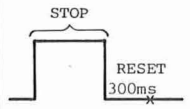
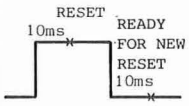
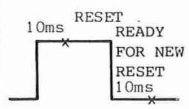
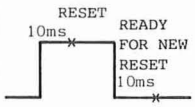
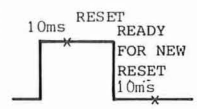
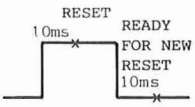
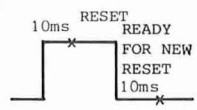
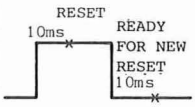
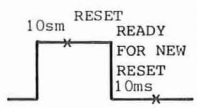
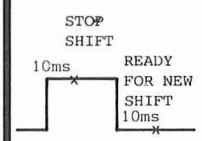
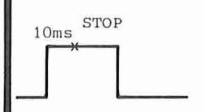
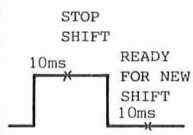
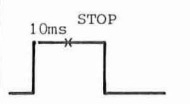
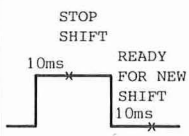
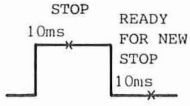
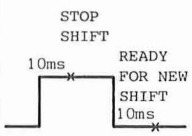
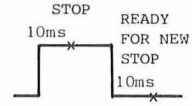
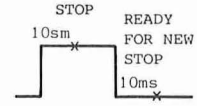
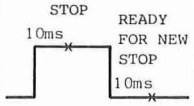
   a) Manual reset with the reset switch
   b) External reset
   c) Automatic reset with overflow x)
   d) Automatic reset on reception of specific digits with the reset switch in AUT. x)

x) If the STOP condition occurs before the delay time has expired, the automatic reset will cancel the just established STOP condition.

2) The V24 print is mounted and the V24 function has been selected.

   a) Manual reset with the reset switch
   b) External reset
   c) By a new transmission being requested after (CT 122 or CT 109), CT 106 and CT 107 have all been OFF.

5.2.1 SURVEY OF STOP/RESET

①	②	③	④	⑤	⑥
SW1-1:CLOSED 3:OPEN 5:OPEN SW3-2:——— 3:———	SW1-1:CLOSED 3:OPEN 5:CLOSED SW3-2:——— 3:———	SW1-1:CLOSED 3:CLOSED 5:OPEN SW3-2:——— 3:———	SW1-1:CLOSED 3:CLOSED 5:CLOSED SW3-2:——— 3:———	SW1-1:OPEN 3:——— 5:OPEN SW3-2:——— 3:———	SW1-1:OPEN 3:——— 5:CLOSED SW3-2:——— 3:———
RESET: 1) MANUAL  2) AUTOMATIC A3/B3+1 A4/B4 A15/B15 } 3000ms 3) EXTERNAL  4) SPECIAL OVERFLOW 5000 ms At shift to ③, ④, ⑤, or ⑥. DIRECT	RESET: 1) MANUAL  2) AUTOMATIC A3/B3+1 A4/B4 A15/B15 } 3000ms 3) EXTERNAL  4) SPECIAL OVERFLOW 5000 ms At shift to ③, ④, ⑤, or ⑥. DIRECT	RESET: 1) MANUAL  2) AUTOMATIC A3/B3+1 A6/B6 } 900ms 3) EXTERNAL  4) SPECIAL OVERFLOW 5000 ms At shift to ① or ②. DIRECT	RESET: 1) MANUAL  2) AUTOMATIC A3/B3+1 900ms 3) EXTERNAL  4) SPECIAL OVERFLOW 5000 ms At shift to ① or ②. DIRECT	RESET: 1) MANUAL  2) AUTOMATIC A3/B3+1 A4/B4 A15/B15 A6/B6 } 250ms 3) EXTERNAL  4) SPECIAL OVERFLOW 5000 ms At shift to ① or ②. DIRECT	RESET: 1) MANUAL  2) AUTOMATIC A3/B3+1 A4/B4 A15/B15 } 250ms 3) EXTERNAL  4) SPECIAL OVERFLOW 5000 ms At shift to ① or ②. DIRECT
STOP: 1) MANUAL  2) AUTOMATIC A6/B6 DIRECT 3) EXTERNAL  	STOP: 1) MANUAL  3) EXTERNAL  	STOP: 1) MANUAL  2) AUTOMATIC A4/B4 A15/B15 } DIRECT 3) EXTERNAL  4) SPECIAL AO/BO DIRECT	STOP: 1) MANUAL  2) AUTOMATIC A4/B4 A15/B15 } DIRECT 3) EXTERNAL  4) SPECIAL AO/BO DIRECT	STOP: 3) EXTERNAL  4) SPECIAL a) If either CTlo6,CTlo7,CT122 go 'OFF'. b) If either CTlo6,CTlo7,CTlo9 go 'OFF' c) No answer to three subsequent blocks. d) Switch from V24 SELECTED to NON-SELECTED	STOP: 3) EXTERNAL  4) SPECIAL a) If either CTlo6,CTlo7,CT122 go 'OFF'. b) If either CTlo6,CTlo7,CTlo9 go 'OFF' c) No answer to three subsequent blocks. d) Switch from V24 SELECTED to NON-SELECTED

5.3 Meaning of Signals

FORWARD SIGNALS, GROUP I

When First Signal on an International Circuit		When Other than the First Signal on an International Circuit
I - 1	LANGUAGE DIGIT: FRENCH	DIGIT 1
I - 2	- - ENGLISH	- 2
I - 3	- - GERMAN	- 3
I - 4	- - RUSSIAN	- 4
I - 5	- - SPANISH	- 5
I - 6	- - SPARE	- 6
I - 7	- - SPARE	- 7
I - 8	- - SPARE	- 8
I - 9	DISCRIMINATING DIGIT: SPARE	- 9
I - 10	DISCRIMINATING DIGIT	- 10
I - 11	COUNTRY CODE INDICATOR OUTGOING HALF-ECHO SUPPRESSOR REQUIRED	CODE 11 (ACCESS TO INCOMING OPERATOR)
I - 12	COUNTRY CODE INDICATOR NO ECHO. SUPPRESSOR REQUIRED	*a)* CODE 12 (ACCESS TO DELAY OPERATOR) *b)* REQUEST NOT ACCEPTED
I - 13	TEST CALL INDICATOR (CALL BY AUTOMATIC TEST EQUIPMENT)	CODE 13 (CALL TO AUTOMATIC TEST EQUIPMENT)
I - 14	COUNTRY CODE INDICATOR INCOMING HALF-ECHO SUPPRESSOR REQUIRED	INCOMING HALF-ECHO SUPPRESSOR REQUIRED
I - 15		CODE 15 (END OF PULSING)

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FORWARD SIGNALS, GROUP II (in reply to A-3 and A-5)

II - 1	SUBSCRIBER INITIATED CALL	NATIONAL *
II - 2	PRIORITY CALL	
II - 3	MAINTENANCE EQUIPMENT CALL	
II - 4	SPARE	
II - 5	OPERATOR INITIATED CALL	
II - 6	DATA TRANSMISSION CALL	
II - 7	SUBSCRIBER OR OPERATOR INITIATED CALL WITHOUT FORWARD TRANSFER FACILITY	INTERNATIONAL
II - 8	DATA TRANSMISSION CALL	
II - 9	SUBSCRIBER WITH PRIORITY	
II - 10	OPERATOR INITIATED CALL WITH FORWARD TRANSFER FACILITY	
II - 11	SPARE SIGNAL	NATIONAL *
II - 12	SPARE SIGNAL	
II - 13	SPARE SIGNAL	
II - 14	SPARE SIGNAL	
II - 15	SPARE SIGNAL	

* THE OUTGOING INTERNATIONAL R2 REGISTER RECEIVING ONE OF THESE SIGNALS CONVERTS IT INTO ONE OF THE FOLLOWING:

II-7, II-8, II-9, or II-10

BACKWARD SIGNALS, GROUPS A AND B

A - 1	SEND NEXT DIGIT (n+1)	B - 1	SPARE SIGNALS FOR NATIONAL USE
A - 2	SEND LAST BUT ONE DIGIT (n-1)	B - 2	SUBSCRIBER TRANSFERRED
A - 3	ADDRESS-COMPLETE, CHANGEOVER TO RECEPTION OF B SIGNALS	B - 3	SUBSCRIBER ENGAGED
A - 4	CONGESTION ON NATIONAL NETWORK	B - 4	CONGESTION
A - 5	SEND CALLING PARTY's CATEGORY	B - 5	UNALLOCATED NUMBER
A - 6	ADDRESS-COMPLETE, CHARGE, SET UP SPEECH CONDITIONS	B - 6	SUBSCRIBER LINE FREE, CHARGE
A - 7	SEND LAST BUT TWO DIGITS (n-2)	B - 7	SUBSCRIBER LINE FREE, NO CHARGE
A - 8	SEND LAST BUT THREE DIGITS (n-3)	B - 8	SUBSCRIBER LINE OUT OF ORDER
A - 9	SPARE SIGNALS FOR NATIONAL USE	B - 9	SPARE SIGNALS FOR NATIONAL USE
A-10	SPARE SIGNALS FOR NATIONAL USE	B-10	SPARE SIGNALS FOR NATIONAL USE
A-11	SEND COUNTRY CODE INDICATOR	B-11	SPARE SIGNALS FOR INTERNATIONAL USE
A-12	SEND LANGUAGE OR DISCRIMINATING DIGIT	B-12	as above
A-13	SEND LOCATION OF OUTGOING INTERNATIONAL R2 REGISTER	B-13	as above
A-14	IS AN INCOMING HALF-ECHO SUPPRESSOR REQUIRED?	B-14	as above
A-15	CONGESTION IN INTERNATIONAL EXCHANGE OR AT ITS OUTPUT	B-15	as above

5.4 GROUNDING OF TERMINALS CONNECTED TO THE MFC DISPLAY

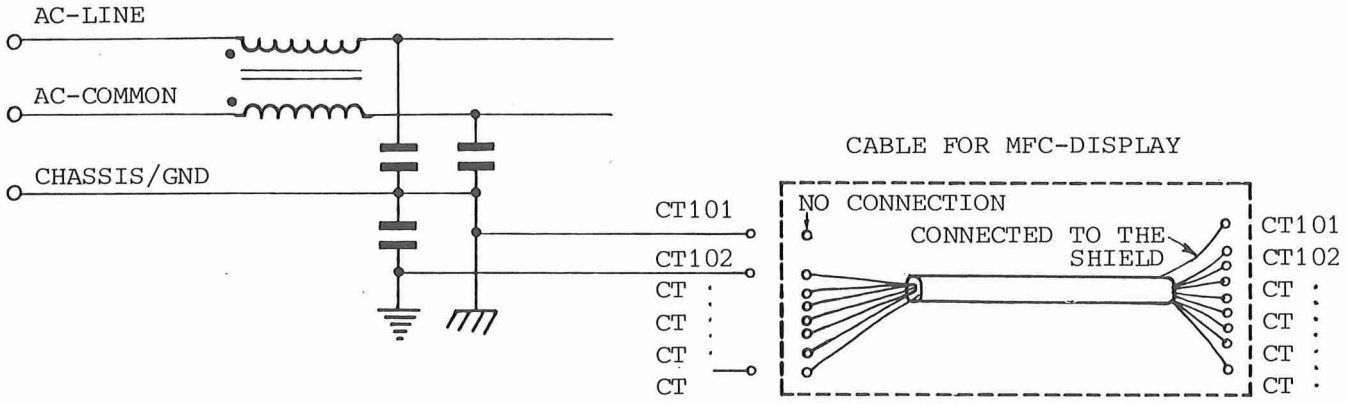
It is recommended to ground terminals, which should be connected to the V24 interface connector of the MFC DISPLAY if they have a power supply corresponding to 1) or 2) as shown below.

At the same time is shown that only CT 101 in the cable should be connected to the MFC DISPLAY side.

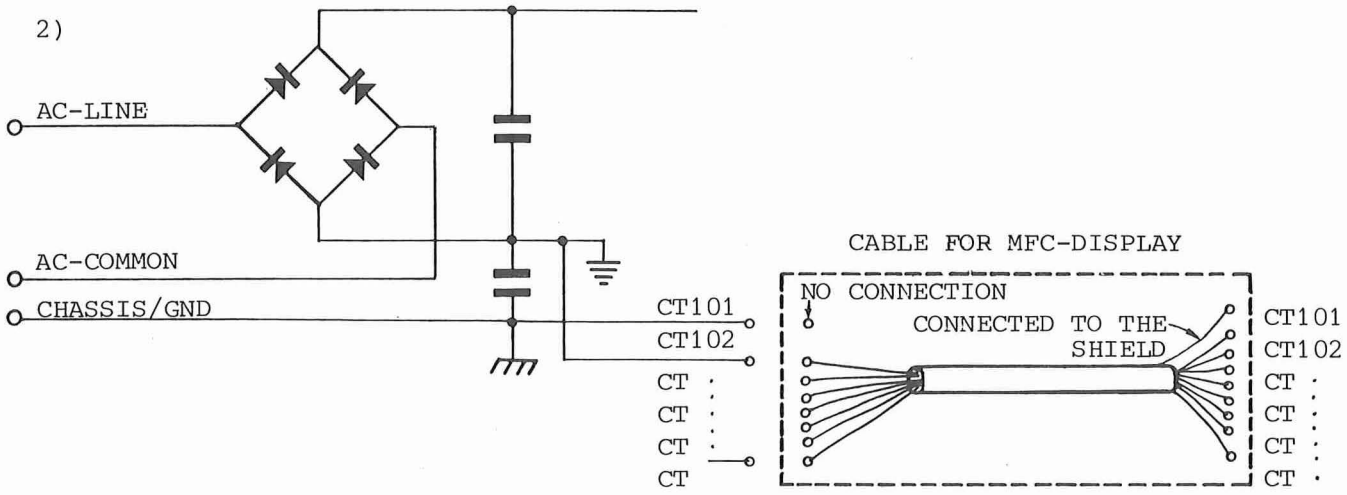
This is due to the fact that by connecting the mains voltage (220 V/50 Hz) to for instance terminal 1), 110 V AC will be applied to CT 102. If a ground loop is now formed through the 0 V of the MFC DISPLAY and out through the input terminals to ground, this will result in an input voltage of 110 mV AC at the input balance of 60 dB of the MFC DISPLAY, the result being that reading in is blocked.

The MFC DISPLAY is class II isolated, which implies that the instrument may not be ground-connected. If ground is now connected to the terminals, it may not be connected to the MFC DISPLAY through CT 101.

1)



2)



6. SERVICE

If it is established that a fault does exist in the MFC-DISPLAY, please contact your ELMI-agent, who will help you restore your MFC-DISPLAY to its proper condition.

To order replacement parts, address order or inquiry either to yor authorized representative or to:

ELMI A/S
90, KIRKEBJERG ALLE
DK-2600 GLOSTRUP
DENMARK

PHONE : National: 02-45 42 11
International:+ 45 2 45 42 11
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7. ZYYK 15005 SELECTION

7.1 INTRODUCTION

For fault-finding purposes ELMI has designed an option - selection - which makes it possible to print out certain user-specified selections only. This might be the case e.g. where only calls with retransmissions are considered interesting. Also more advanced selections can be made by demanding fulfilment of several criteria at the same time, e.g. retransmission and blocking in the same call.

Selection choices of that type will greatly facilitate faultfinding - as the volume of calls is automatically reduced to include only those that are of interest to the user.

The facility for selecting certain (groups of) calls makes it possible to use the equipment also in connection with statistical measurements, traffic distribution, etc.

This option is an addition to the normal function of the MFC-D as - after power-up - a function equal to the present MFC-D is started , with all calls being shown in the display and via the V.24. The option does not come into operation until the moment when programming of the MFC-D (via the V.24 interface) is requested.

HARDWARE

Selection requires that the MFC-D is equipped with a selective card and a V.24 card, as the communication occurs via the V.24 interface.

The selection card contains the detection algorithms and the input/output routines, whereas the V.24 card contains the V.24 interface with associated software drivers.

7.1.1 Typical Use of MFC-D with Selection

Before the MFC-D can be used selectively, it is necessary to input information on the criteria determining the selection. This is done by entering a "P" via the connected V.24 terminal, and this is interpreted by the MFC-D as a command to guide the user through a programming session.

Concurrently with the start of programming, the registration of calls stops - so as to prevent a mix-up of calls and programming data.

After having received a programming command, the MFC-D automatically guides the user through the necessary parameters by printing these out in plain language, together with their present value. An example of such programming is shown below:

```
P
DATE = 0000-01-01
       1982-02-24
TIME = 00:01
       09-30
START OF MEASUREMENT = 00:00

END OF MEASUREMENT = 00:00

CRIT. # 0 = NOT IN USE
            F1 AX454211
CRIT. # 1 = NOT IN USE
            BA 2
CRIT. # 2 = NOT IN USE
            BB6
#
CRIT. # 2 = NOT IN USE
            BB 6
CRIT. # 3 = NOT IN USE

COMB. # 0 = NOT IN USE
            0,2
COMB. # 1 = NOT IN USE

FORMAT = NORMAL

DISPLAY = NORMAL

BAUDRATE = 1200

READY
GO
```

After having received the "P" as shown at the top, the MFC-D will begin to request data for the printed parameters - line by line.

7.1.2 General Facts about Parameters and Entry

The MFC-D prints out a parameter and its current value, followed by a line shift and an indent consisting of blanks, so that the printer head is placed precisely below the first character of the parameter value.

This leaves the user with two possibilities: he may allow the parameter to continue in force (by pressing RETURN), or he may enter a new parameter value followed by RETURN to indicate that the entry of this parameter has been completed. Provided that the entered parameter is valid (and therefore accepted by the MFC-D), the MFC-D will respond by printing out a new line with a '#' and repeat the parameter with the original value (see CRIT. #2).

If an error is detected during the entry of data, it is possible to correct it directly by pressing DEL, which causes the last character entered to be deleted, and the correct character is entered in its place (see COMB. #0).

In many cases only very few parameters will be needed. For this reason the option features a jump command. The entire programming block is divided into four blocks. The first block consists of the program up to the criteria, the second block of the criteria, the third of the combinations, and the fourth block of the parameters relating to the presentation of the data printed out. The jump order used is 'ESC'. For instance, pressing 'P' and 'ESC' three times will jump to the parameter FORMAT. Pressing 'ESC' in the last block, or when all programming data have been entered, will cause a 'READY' to be printed out to indicate that all data are ready now and that the unit is ready to start measuring. Measuring is commenced by entering 'GO', and the unit responds by a line shift and a beep. The unit will then start measuring on the line to determine MFC signalling. In order to ensure that only full calls are made, the first call will not be printed out, since the measurement might have begun in the middle of a call. (The counters, however, are summed up).

At a random time during the measurement, it is possible to get a status printout by pressing 'S'. It is then possible to see how many calls have met the criteria and combinations of these and the total number of calls:

```
S
15:42 DATE = 1982-02-24
15:42 TIME = 15:42
15:42 START OF MEASUREMENT = 00:00
15:42 END OF MEASUREMENT = 00:00
15:42 CRIT. # 0 = F1 AX454211          COUNTER # 0 = 0001
15:42 CRIT. # 1 = BA 2                 COUNTER # 1 = 0007
15:42 CRIT. # 2 = BB 6                 COUNTER # 2 = 0020
15:42 CRIT. # 3 = NOT IN USE           COUNTER # 3 = 0000
15:42 CRIT. # 4 = NOT IN USE           COUNTER # 4 = 0000
15:42 CRIT. # 5 = NOT IN USE           COUNTER # 5 = 0000
15:42 CRIT. # 6 = NOT IN USE           COUNTER # 6 = 0000
15:42 CRIT. # 7 = NOT IN USE           COUNTER # 7 = 0000
15:42 CRIT. # 8 = NOT IN USE           COUNTER # 8 = 0000
15:42 CRIT. # 9 = NOT IN USE           COUNTER # 9 = 0000
15:42                                  TOTAL     = 000028
15:42 COMB. # 0 = 0,2                  COUNTER # 0 = 0001
15:42 COMB. # 1 = NOT IN USE           COUNTER # 1 = 0000
15:42 COMB. # 2 = NOT IN USE           COUNTER # 2 = 0000
15:42 COMB. # 3 = NOT IN USE           COUNTER # 3 = 0000
15:42 COMB. # 4 = NOT IN USE           COUNTER # 4 = 0000
15:42 COMB. # 5 = NOT IN USE           COUNTER # 5 = 0000
15:42 COMB. # 6 = NOT IN USE           COUNTER # 6 = 0000
15:42 COMB. # 7 = NOT IN USE           COUNTER # 7 = 0000
15:42 COMB. # 8 = NOT IN USE           COUNTER # 8 = 0000
15:42 COMB. # 9 = NOT IN USE           COUNTER # 9 = 0000
15:42 FORMAT = NORMAL
15:42 DISPLAY = NORMAL
15:42 BAUDRATE = 1200
```

In this case there were a total of 28 calls. One of these was printed out, viz. the one where the combination consisting of the criteria 0 and 2 were complied with at the same time.

In the current case it was the call

15:29
F: A24542111
B: 111111136

that was printed out. This is seen to be correct, as forward group 1 signalling is A2454211, which complies with criterion 0 (X indicates a random digit), and there is furthermore a backward-going group B signal of the value 6.

This is only one example of the use of selection in connection with MFC-D. Below follows a detailed description of the way in which MFC-D is used selectively.

7.2 PROGRAMMING

At a random time after power-on it is possible to interrupt the measurement in progress and start programming by entering the ASCII-character 'P'. This character will cause the measurement in progress to be interrupted, and the counters for criteria and combinations are reset.

Data loading is controlled by the MFC-Display, as the instrument responds to the character 'P' by printing out the first parameter, the date, and its present value.

The user will then have to enter a new (legal) value for it, or choose to let the old value continue to apply by simply pressing RETURN.

The following parameters can be programmed:

* The date
* The time
* The start time of day for start of measuring period
* The stop time of day for stop of measuring period
* Selection criteria (from zero to ten criteria)
* Combination selection of criteria, such that several criteria will have to be complied with simultaneously before selection of call is made.
* A compressed printout, consisting of the B-number and the number of repeats
* The use of the display
* Baud rate for data gathering unit

After completion of data entry, the unit will print out a 'READY' to indicate that further data entries are not required. Then the unit waits until the user presses 'GO' to indicate that the measurement can start with the entered data.

Pressing 'GO' will cause printout of one blank line, followed by a beep, at the same time as the baud rate is changed to the desired value. The measurement will start at the first reset. The counters will be summed up in accordance with the programmed data, but calls will not be transmitted via the V.24 before a connection has been established.

Below are shown formats for data entry. See also the following examples of programming of the MFC-Display.

It applies to separating characters between year and month, month and day, and hours and minutes that they must be one character, no matter which. However, the instrument will always print out the separating marks as shown in the examples.

7.2.1 Date

The date should be entered as eight digits, starting with 19 to indicate century. No requirements apply to the year, while month and date must be two digits, from 01 to 12 and 01 to 31, respectively.

The incorporated calendar allows for the number of days in the month in question. The initial value for DATE is 0000-01-01.

An example of a date printout:

DATE = 1981-03-31

7.2.2 Time of Day

The time of day is entered as four digits: hours and minutes, starting with the hours. Hours are entered as a

figure between 00 and 23, while minutes must be in the interval 00 to 59.

The initial value of TIME is 00:00 after power-up, and the watch runs currently.

An example of a time printout:

TIME = 10:52

7.2.3 Start of Measurement

This parameter is used for time monitoring of the measuring process. This is to be understood so that using this parameter, and the following, it is possible to choose to have the measurements performed within a specific time interval. As an example may be mentioned the possibility of only recording data during busy hours.

Format is as for time: four digits should be entered, corresponding to hours and minutes. If 00:00 is entered here instead of the usual time, the instrument will take it as if the measurement will be performed independently of the time, i.e. a constant supervision of the lines.

If time — as indicated by the built-in timer of the MFC-D — is between the programmed start and stop times, the measurement will not start until the following day at start time. This is designed to prevent subsequent receipt of printouts where the start and stop times provide one measured period, but where the actual measured period was in fact shorter.

The initial value is 00:00, corresponding to constant measurement.

After power-up, both start and stop of the measurement will be set at the initial value, corresponding to a constant measurement.

An example of a printout of START OF MEASUREMENT:

START OF MEASUREMENT = 11:00

7.2.4 Stop of Measurement

The function is used together with the function above. Only here it is a question of the time at which the measurement is to stop. If 00:00 has been entered to indicate 'start of measurement', this parameter will be irrelevant.

The initial value is 00:00.

An example of a printout of END OF MEASUREMENT:

END OF MEASUREMENT = 12:00

7.2.5 Selection Criteria

It is possible to preprogram from zero to ten criteria for printout of recorded calls. These are preprogrammed independently of one another, and only then it is possible to combine several criteria by means of combination formulae, such that a printout is conditional upon several criteria having been met. In this way it is possible to make a logical expression for printout of a call. This will be a function of ''AND' and 'OR' of several criteria.

Each of the criteria must be one of the following types:

F1 forward group 1 signalling, which will normally be used for searching a B-number. The B-number in question must then be entered. The search for the B-number takes into consideration category signals and retransmissions. The criterion is accepted as soon as it has been complied with - also if the call is longer. A B-number is assumed only to consist of the digits 1 ... 9, A. Other signals are ignored.

The forward group 1 signals B, C, D, E and F may also be used as criteria. In that case only one digit may be entered (B, C, D, E, or F).

F2 forward group 2 signal. A random digit may be entered.

BA Backward group A. One digit may be entered, and the instrument will then search for this digit through the entire call. 0 (no signal) is interpreted as a 1.

BB Backward group B. One digit may be entered, and the instrument will then search for the digit in question between the group B signals.

B0 Here 0 may be entered as the only possibility, so that in total B0 0 must be entered, which means that the instrument searches for a backward 0 (no signal) as the last 'digit' in a call.

MX A sequence of digits may be entered here, to be interpreted as a sequence of alternately forward and backward signals, with the first digit assumed to be a backward group A-signal.

A blank (space) must follow after type of criterion, and then the criterion itself.

Up to 20 digits may be entered for forward group 1 (B-number) and mixed criteria.

Forward group 1 (B, C, D, E, or F), forward group 2, backward group A and B and 0 should be entered as one digit.

An 'X' may be entered in the groups F1 (only in connection with a B-number), MX, F2, BA, and BB, corresponding to a random signal (don't care) being in the position in question.

It is possible to delete a previously entered criterion by entering 'NOT IN USE'. Only the four first characters are significant. The initial value of all criteria is 'NOT IN USE'.

An example of the format of a criterion entry:

```
CRIT. # 0 = F1 A2454211
CRIT. # 1 = F1 B
CRIT. # 2 = F2 4
CRIT. # 3 = BA 1
CRIT. # 4 = BB 6
CRIT. # 5 = BØ Ø
CRIT. # 6 = MX 3X6
CRIT. # 7 = F1 A245
CRIT. # 8 = BA 3
CRIT. # 9 = NOT IN USE
```

7.2.6 Choice of Combination

By means of up to 10 combinations it is possible to make a printout of a call conditional upon several criteria being complied with simultaneously. If one or more of these combinations are used, only calls complying with the criteria given in a combination will be printed out. This combination facility corresponds to the 'AND-function', a function of simultaneity.

The combinations should be entered as a digit sequence of criteria, separated by commas. To delete a combination, enter 'NOT IN USE' (in practice it is sufficient to enter the first two letters). If only one digit is entered, it is assumed to have the same significance as a combination of two identical criteria!

The initial value of the combinations is 'NOT IN USE'.

If COMB #0 is fulfilled, a signal will go active on pin 21 of the parallel data output connection at the rear of the instrument. The output goes active upon completion of the call received. Resetting of the signal is done by manual reset or by an external reset.

An example of the format of a combination entry:

COMB. # 0 : 1,3,4

COMB. # 1 : 2,2

COMB. # 2 : NOT IN USE

7.2.7 Printout Format

It is possible to select between different printout formats; both are described under the V.24 data format. The one format will cause a printout of all recorded signals (both backward and forward) in a selected call, while the other, the compressed printout, will print out the B-number together with the sum of A2's in the call. Format is selected by means of the parameter FORMAT.

The two printout formats are designated NORMAL and COMPRESSED, respectively. For programming purposes it is sufficient to enter the two first digits to obtain the desired format. If only 'RETURN' is pressed, the already stored value will be used.

The initial value of FORMAT is NORMAL:

An example of a normal printout:

F: 613A661
B: 1111136

An example of a compressed printout:

B-NUMBER: 454211 A2=0

Examples of FORMAT:

FORMAT = NORMAL
FORMAT = COMPRESSED

7.2.8 Display

The operator can freely choose whether the display is to show the first selected call to be decoded, the last selected call, or simply show all calls received.

Examples of printouts:

DISPLAY = FIRST

DISPLAY = LAST

DISPLAY = NORMAL

7.2.9 Baud Rate

This parameter has been incorporated as it is not a given fact that it is desirable to transmit programming data and data corresponding to the selected calls with the same speed. Using this it is possible either to enter 300 or 1200 baud. If it is desirable to use the same terminal as for the programming in progress, it is either possible to enter the baud rate in question or simply press 'RETURN'. The initial value of BAUDRATE is determined by the setting of selector SW3-2 on the V.24 card (see under V.24 format).

An example of a printout:

BAUDRATE = 300

7.2.10 Data Entry Completed

This is simply indicated by the message 'READY' displayed on the terminal. Now the MFCD will wait until it receives the 'GO' command to indicate start of a measurement.

7.2.11 Entry Faults

While programming, there is a risk of making errors in data entry. It is possible to delete the last character entered by simply pressing the button 'DEL' or 'RUB OUT'. The terminal will respond by going one position backwards, so that the next character will be written in the position of the one erroneously entered.

In this way it is possible to delete several characters after one another; however, it is not possible to delete more than the parameter currently being entered.

Attempts to delete more information will not give any visible effect, but a warning beep will be sounded from the terminal to indicate that an attempt has been made to execute an illegal operation.

An example of erroneous data entry is the entry of lower-case characters.

7.2.12 Internal Control of Values Entered

After each value entered the instrument will check that the value is within certain limits, given by the current parameter type:

Minutes:	Requiring a value between 00 and 59
Hours:	Requiring a value between 00 and 23
Day:	Requiring a value between 01 and 31
Month:	Requiring a value between 01 and 12
Year:	Requiring a 4-digit figure only
Criteria:	The number of digits may not be exceeded

7.2.13 Division of Programming Sequence

The programming consists of four blocks:

1) Date, time, and start and stop of measurement
2) Entry of criteria
3) Entry of combinations
4) Printout format, display use and V.24 transmission speed

Pressing 'ESC' (Escape) instead of the usual entry of parameter will cause the instrument to jump to the start of the next group in order to continue the programming sequence from there.

This is important where, for instance, it is desirable to combine two criteria. Then, after having entered the two criteria in reply to the instrument's printout of criterion 3, 'ESC' can be entered, and the instrument will now print out combination No. 0.

7.2.14 Normal Operation (= Measurement)

When all parameters have been loaded into the MFCD, the instrument will automatically print out a 'READY' message to indicate that it waits for the start signal from the V.24 section - recorded at the reception of 'GO'. Pressing 'GO' will cause the baud rate to be changed to the desired rate, at the same time as the instrument begins to measure on the line.

The measurement starts at the first reset. The counters will be summed up in accordance with the recorded calls; but the call will not be transmitted via the V.24 until connection has been established. The counters will still be summed up if there is a disconnection, for which reason the counter figure may exceed the number of calls established.

7.2.15 Resetting the Counters

A programming will cause resetting of all counters, for which reason it will often be an advantage to print out a status prior to programming, as the status printout will show the counter values and leaves these untouched.

7.3. STATUS PRINTOUT

During normal measuring it is possible to obtain a status printout by pressing 'S' on the printer connected to the V.24 section of the instrument. Another way is to disconnect the V.24 section. At the subsequent connection the transmission will be started with a status printout.

A status printout will indicate status of the measurement at a given moment. This is done in the form of a printout showing the criteria entered, the combinations selected, and the associated counters. Moreover, there is a counter indicating the total number of calls since the last programming.

These counters will always be summed up. This means that if the connected V.24 section is disconnected for some reason for a short or long period, there will (perhaps) lack a printout of selected calls. Requesting a status printout will show the recordings made, and comparing this with previous status printouts and selected calls will make it possible to determine whether any calls have been lost (as well as the type of calls!).

7.4 EXAMPLES

Below follow some examples of the use of MFC-D with selection.

7.4.1 Example 1

It is desired to see all calls, and for this reason it is not necessary to program any criteria. On the other hand, it is only desired to measure during busy hours. A programming will therefore look as follows:

```
P
DATE = 0000-01-01
       1982-03-09
TIME = 00:01
       09:55
START OF MEASUREMENT = 00:00
                       10:00
END OF MEASUREMENT = 00:00
                     11:00
CRIT. # 0 = NOT IN USE

COMB. # 0 = NOT IN USE

FORMAT = NORMAL

READY
GO
```

Note that the jump command 'ESC' has been used, and that the busy hour is here assumed to be between 10.00 and 11.00. This will cause the following printout of calls:

```
10:02
F: 96159A11
B: 71111136
10:02
F: 6156159A11
B: 1171111136
10:02
F: 6156159A11
B: 1171111136
10:02
F: E1453613A660
B: 511111111116
```

The instrument will stop measuring at 11.00 o'clock and only resume measuring on the following day at 10.00 o'clock.

If it is desired to see blocked calls, it is now possible directly to see which calls are blocked - and how many. However, this is not the most rational method to search for blocked calls (see the example below).

7.4.2 Example 2

If it is desired to have a printout of blocked calls, the following programming can be made, where the relevant calls are indicated by containing either group A signal 4, group A signal F, or group B signal 4.

It is desired to supervise the line round the clock.

As only blocked calls are of interest, it is further selected to let the display show the last call selected. This can be done by the following programming sequence:

```
P
DATE = 0000-01-01
       1982-03-09
TIME = 00:01
       13.15
START OF MEASUREMENT = 00:00

CRIT. # 0 = NOT IN USE
            BA 4
CRIT. # 1 = NOT IN USE
            BB 4
CRIT. # 2 = NOT IN USE
            BA F
CRIT. # 3 = NOT IN USE

COMB. # 0 = NOT IN USE

FORMAT = NORMAL

DISPLAY = NORMAL
          LAST
BAUDRATE = 1200

READY
GO
```

During the measurement the display will show all calls until the first blocked call appears. This will for instance be the call:

```
13:19
F: 4542
B: 1114
```

Then this call remains displayed until the next blocked call is located.

At a random time during the measurement it is possible to order a printout of the immediate instrument status. This is done by entering 'S':

```
S
13:52 DATE = 1982-03-09
13:52 TIME = 13:52
13:52 START OF MEASUREMENT = 00:00
13:52 END OF MEASUREMENT = 00:00
13:52 CRIT. # 0 = BA 4                  COUNTER # 0 = 0002
13:52 CRIT. # 1 = BB 4                  COUNTER # 1 = 0002
13:52 CRIT. # 2 = BA F                  COUNTER # 2 = 0002
13:52 CRIT. # 3 = NOT IN USE            COUNTER # 3 = 0000
13:52 CRIT. # 4 = NOT IN USE            COUNTER # 4 = 0000
13:52 CRIT. # 5 = NOT IN USE            COUNTER # 5 = 0000
13:52 CRIT. # 6 = NOT IN USE            COUNTER # 6 = 0000
13:52 CRIT. # 7 = NOT IN USE            COUNTER # 7 = 0000
13:52 CRIT. # 8 = NOT IN USE            COUNTER # 8 = 0000
13:52 CRIT. # 9 = NOT IN USE            COUNTER # 9 = 0000
13:52                                   TOTAL     = 000140
13:52 COMB. # 0 = NOT IN USE            COUNTER # 0 = 0000
13:52 COMB. # 1 = NOT IN USE            COUNTER # 1 = 0000
13:52 COMB. # 2 = NOT IN USE            COUNTER # 2 = 0000
13:52 COMB. # 3 = NOT IN USE            COUNTER # 3 = 0000
13:52 COMB. # 4 = NOT IN USE            COUNTER # 4 = 0000
13:52 COMB. # 5 = NOT IN USE            COUNTER # 5 = 0000
13:52 COMB. # 6 = NOT IN USE            COUNTER # 6 = 0000
13:52 COMB. # 7 = NOT IN USE            COUNTER # 7 = 0000
13:52 COMB. # 8 = NOT IN USE            COUNTER # 8 = 0000
13:52 COMB. # 9 = NOT IN USE            COUNTER # 9 = 0000
13:52 FORMAT = NORMAL
13:52 DISPLAY = LAST
13:52 BAUDRATE = 1200
```

From this status printout it appears that among the 140 calls since the programming, there have been a total of 6 blocked calls, with two being ended by A4, two by AF, and two by B4.

The measurement is not disturbed by this printout.

7.4.3 Example 3

In certain cases it would be desirable to know how many calls are made in various directions. For instance, it might be desired to know how many calls are made to areas outside one's own.

This can be done by selecting international calls, and calls beginning with area numbers, corresponding to the B-numbers AA9 and AX being entered. The latter means that a selection is made of all calls having two or more digits, starting with a zero. Further, if it is particularly desired to know the number of calls in directions A1, A2, and A3, these may also be entered as criteria.

Such a programming may take the following form:

```
P
DATE = 0000-01-01
       1982-03-09
TIME = 00:01
       14:07
START OF MEASUREMENT = 00:00

CRIT. # 0 = NOT IN USE
            F1 A1
CRIT. # 1 = NOT IN USE
            F1 A2
CRIT. # 2 = NOT IN USE
            F1 A3
CRIT. # 3 = NOT IN USE
            F1 AA9
CRIT. # 4 = NOT IN USE
            F1 AX
CRIT. # 5 = NOT IN USE

COMB. # 0 = NOT IN USE

FORMAT = NORMAL

READY
GO
```

In order to make use of the information, a status printout must be ordered. This will show the number of total calls and distributed on the various directions:

```
S
14:23 DATE = 1982-03-09
14:23 TIME = 14:32
14:23 START OF MEASUREMENT = 00:00
14:23 END OF MEASUREMENT = 00:00
14:23 CRIT. # 0 = F1 A1                 COUNTER # 0 = 0006
14:23 CRIT. # 1 = F1 A2                 COUNTER # 1 = 0005
14:23 CRIT. # 2 = F1 A3                 COUNTER # 2 = 0001
14:23 CRIT. # 3 = F1 AA9                COUNTER # 3 = 0002
14:23 CRIT. # 4 = F1 AX                 COUNTER # 4 = 0024
14:23 CRIT. # 5 = NOT IN USE            COUNTER # 5 = 0000
14:23 CRIT. # 6 = NOT IN USE            COUNTER # 6 = 0000
14:23 CRIT. # 7 = NOT IN USE            COUNTER # 7 = 0000
14:23 CRIT. # 8 = NOT IN USE            COUNTER # 8 = 0000
14:23 CRIT. # 9 = NOT IN USE            COUNTER # 9 = 0000
14:23                                   TOTAL     = 000068
14:23 COMB. # 0 = NOT IN USE            COUNTER # 0 = 0000
14:23 COMB. # 1 = NOT IN USE            COUNTER # 1 = 0000
14:23 COMB. # 2 = NOT IN USE            COUNTER # 2 = 0000
14:23 COMB. # 3 = NOT IN USE            COUNTER # 3 = 0000
14:23 COMB. # 4 = NOT IN USE            COUNTER # 4 = 0000
14:23 COMB. # 5 = NOT IN USE            COUNTER # 5 = 0000
14:23 COMB. # 6 = NOT IN USE            COUNTER # 6 = 0000
14:23 COMB. # 7 = NOT IN USE            COUNTER # 7 = 0000
14:23 COMB. # 8 = NOT IN USE            COUNTER # 8 = 0000
14:23 COMB. # 9 = NOT IN USE            COUNTER # 9 = 0000
14:23 FORMAT = NORMAL
14:23 DISPLAY = NORMAL
14:23 BAUDRATE = 1200
```

From the printout can be seen that out of 68 calls two are international calls, and 24 are to subscribers outside one's own area. Moreover, information is given about the distribution of the 24 calls on the basis of the criteria 0, 1, and 2.

For instance, this call has been made between the programming and the status printout:

```
14:12
F: A17A178A7A6101
B: 11711111115136
```

As will be seen, it is also possible to use this option in connection with traffic measurements.

7.4.4 Example 4

When it is only desired to get information about the B-number, it is possible to make use of the possibility of entering 'COM' in reply to FORMAT. In this way the calls will be printed out in a more compact way that is easier to survey. Only the actual B-number is printed out: retransmisions in the form of A2, A7 and A8 are taken into consideration.

This means that the following format is obtained, depending upon FORMAT. A2 has been used in the retransmission sense (selector SW4-1 closed).

Compressed Printout

```
15:00
B-NUMBER: 454211 A2= 02
15:00
B-NUMBER: 454211 A2= 00
```

Normal Printout

```
15:00
F: 45424544542111
B: 11121121111136
15:00
F: 43542113
B: 51111136
```

7.4.5 Example 5

The following programming example serves as an example of the combination of several criteria.

Such a programming will be relevant where a printout is to be made conditional upon several criteria being met at the same time. Using the combination facility will only cause printout when one or more combinations have been complied with; therefore, it may be desirable in certain cases to combine a criterion with itself in order to fulfil thr criterion to get a printout.

In the programming shown below it is desired to see blocked calls, which at the same time must be in the group 45. Further, a printout is desired to be made when a call is made by the maintenance equipment, indicated by the forward group 2 signal being 3.

```
P
DATE = 0000-01-01
       1982-03-10
TIME = 00:01
       09:30
START OF MEASUREMENT = 00:00

CRIT. # 0 = NOT IN USE
            F1 45
CRIT. # 1 = NOT IN USE
            BA4
#
CRIT. # 1 = NOT IN USE
            BA 4
CRIT. # 2 = NOT IN USE
            BB 4
CRIT. # 3 = NOT IN USE
            BA F
CRIT. # 4 = NOT IN USE
            F2 3
CRIT. # 5 = NOT IN USE

COMB. # 0 = NOT IN USE
            0,1
COMB. # 1 = NOT IN USE
            0,2
COMB. # 2 = NOT IN USE
            0,3
COMB. # 3 = NOT IN USE
            4,4
COMB. # 4 = NOT IN USE

FORMAT = NORMAL

READY
GO
```

Note that an erroneous entry is made in CRIT. # 1, as there is no blank between A and 4. The instrument indicates the error and repeats the line.

A printout of the calls may take the following form:

```
09:42
F: 4542111
B: 1111134
09:42
F: 4542
B: 1114
09:43
F: 4542113
B: 1111136
09:47
F: 43542113
B: 51111136
```

7.5 MEANING OF SIGNAL A2

By means of the switch SW4-1, the instrument can be set to record R2-signalling (SW4-1 open), or an often used variant, where the signal A2 is used in the retransmission sense (SW4-1 closed).

7.6 ACKNOWLEDGEMENT

Using the switch SW1-2 it is possible to select whether the transmission is to take place with block checks at the end of each blocks and acknowledgement in the form of ACK/NAK. This is obtained with SW1-2 open.

If SW1-2 is closed, a block check character (BCC) is not transmitted at the end of each block, and the instrument does not wait for ACK/NAK (ignored).

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8. OUTPUT VIA THE V.24 INTERFACE

8.1 INTRODUCTION

The instrument is equipped with V.24/V.28 interface towards V.23 and V.21 modem for asynchronous data transmission.

Towards a V.23 modem the transmission may be either 1,200 baud simplex w/ backward channel for 75 baud - or 1,200 baud full duplex; at the same time it is possible to choose between the use of ACK/NAK or without answer (CARRIER only).

Towards a V. 21 modem, transmission occurs at 300 baud full duplex; at the same time it is possible to choose between the use of ACK/NAK or without answer (CARRIER only).

If the instrument is waiting for ACK/NAK and nothing is received within 0.5 sec., the system assumes that NAK has been received.

If characters different from ACK/NAK or characters with parity errors are received, the system assumes that no character whatsoever has been received.

If no answer is received to three subsequent blocks, the instrument will go into STOP and cut the connection.

If NAK is received in a block, the block is retransmitted once; if another NAK is received, it is treated as an ACK.

8.2 V.24 INTERCHANGE CIRCUITS (CT LINES) USED:

CT 102	7	Signal ground or common return
CT 103	2	Transmitted data
CT 104	3	Received data
CT 105	4	Request to send
CT 106	5	Ready for sending
CT 107	6	Data set ready
CT 108/2	20	Data terminal ready
CT 109	8	Data channel received line signal detector
CT 111	23	Data signalling rate selector (canc. CT 126)
CT 119	16	Received backward channel data
CT 122	12	Backward channel received line signal detecting
CT 125	22	Calling indicator
CT 101	1	Shield of the cable
CT 126	11	Select transmit frequency (cancels CT 111)

8.3 DATA WORD FRAME

Each data word consists of ten bits, the data of which are standard ASCII characters.

Bit 1:	START	Bit
Bit 2:	DATA	Bit 1
Bit 3:	DATA	Bit 2
Bit 4:	DATA	Bit 3
Bit 5:	DATA	Bit 4
Bit 6:	DATA	Bit 5
Bit 7:	DATA	Bit 6
Bit 8:	DATA	Bit 7
Bit 9:	PARITY	Bit, even par.
Bit 10:	STOP	Bit

8.4 TRANSMITTED DATA VIA THE V.24 INTERFACE

Three categories of data are sent via the V.24 interface. They are (1) decoded calls, (2) status print-out and (3) programming data.

8.4.1 Format in Connection with Calls

The display indicates:

F:	4	5	4	2	1	1	1
B:	1	1	1	1	1	3	6

1	5	10	15
16	20	25	30

When FORMAT = NORMAL, the following is transmitted:

STX	RS	NUL	NUL	1	0	:	3	2	␣	NUL	NUL	NUL	CR	LF	RS	
F	:	␣	4	5	4	2	1	1	1	CR	LF					
B	:	␣	1	1	1	1	1	3	6							
ETX	BCC	CR	LF													

Key to the transmitted characters:

STX	:	Start of text
RS	:	Separator
NUL,NUL	:	Dummy characters
10:32	:	Time for registration of calls (hours:minutes)
␣	:	Space (in the case of a retransmission "space" is replaced by "R").
NUL,NUL		
NUL	:	Dummy characters
CR-LF	:	Carriage return - Line feed
RS	:	Separator
F: ␣	:	F (Forward), colon, space
4542111	:	The forward decoded digits
CR-LF	:	Carriage return - Line feed
B: ␣	:	B (Backwards), colon, space
1111136	:	The backward decoded digits
ETX	:	End of text
BCC	:	Block Check Character: "Exclusive - or" of STX up to and including ETX. The character is cancelled by transmission without the use of ACK/NAK
CR-LF	:	Carriage Return - Line Feed

When FORMAT = COMPRESSED, the following is transmitted:

STX	RS	NUL	NUL	1	0	:	3	2	␣	NUL	NUL	NUL	CR	LF	RS									
B	-	N	U	M	B	E	R	:	␣	4	5	4	2	1	1	␣	A	2	␣	=	␣	0	0	
ETX	BCC	CR	LF																					

STX	:	Start of text
RS	:	Separator
NUL,NUL	:	Dummy characters
10:32	:	Time of registration of calls (hours:minutes)
␣	:	Space (in the case of a retransmission, "space" is replaced by "R")
NUL,NUL,	:	
NUL	:	Dummy characters
CR-LF	:	Carriage return - Line feed
RS	:	Separator
B-number ␣	:	The text: "B-number", colon, space
454211	:	The decoded B-number
␣ A2 ␣ = ␣	:	Space, A2, space, =, space
00	:	The number of decoded backward signals that was equal to A2
ETX	:	End of text
BCC	:	Block Check Character: "Exclusive-or" of STX up to and including ETX. The character is cancelled by transmission without the use of ACK/NAK
CR-CR	:	Carriage return - Line feed

8.4.2 Format in the Case of Status

When printing out status, the format follows the format of calls and looks as follows:

STX RS CR LF 1 0 : 3 2 NUL NUL NUL CR LF RS	1st line	ETX BCC CR LF
STX RS NUL NUL 1 0 : 3 2 NUL NUL NUL CR LF RS	2nd line	ETX BCC CR LF
STX RS NUL NUL 1 0 : 3 2 NUL NUL NUL CR LF RS	3rd line	ETX BCC CR LF
	etc.	
STX RS NUL NUL 1 0 : 3 2 NUL NUL NUL CR LF RS	27th line	ETX BCC CR LF
STX RS NUL NUL 1 0 : 3 2 NUL NUL NUL CR LF RS	28th line	ETX BCC CR LF

where lines Nos. 1 to 28 look as follows:

1.	DATE = 0000-01-01	
2.	TIME = 00:03	
3.	START OF MEASUREMENT = 00:00	
4.	END OF MEASUREMENT = 00:00	
5.	CRIT. # 0 = NOT IN USE	COUNTER # 0 = 0000
6.	CRIT. # 1 = NOT IN USE	COUNTER # 1 = 0000
7.	CRIT. # 2 = NOT IN USE	COUNTER # 2 = 0000
8.	CRIT. # 3 = NOT IN USE	COUNTER # 3 = 0000
9.	CRIT. # 4 = NOT IN USE	COUNTER # 4 = 0000
10.	CRIT. # 5 = NOT IN USE	COUNTER # 5 = 0000
11.	CRIT. # 6 = NOT IN USE	COUNTER # 6 = 0000
12.	CRIT. # 7 = NOT IN USE	COUNTER # 7 = 0000
13.	CRIT. # 8 = NOT IN USE	COUNTER # 8 = 0000
14.	CRIT. # 9 = NOT IN USE	COUNTER # 9 = 0000
15.		TOTAL = 000000
16.	COMB. # 0 = NOT IN USE	COUNTER # 0 = 0000
17.	COMB. # 1 = NOT IN USE	COUNTER # 1 = 0000
18.	COMB. # 2 = NOT IN USE	COUNTER # 2 = 0000
19.	COMB. # 3 = NOT IN USE	COUNTER # 3 = 0000
20.	COMB. # 4 = NOT IN USE	COUNTER # 4 = 0000
21.	COMB. # 5 = NOT IN USE	COUNTER # 5 = 0000
22.	COMB. # 6 = NOT IN USE	COUNTER # 6 = 0000
23.	COMB. # 7 = NOT IN USE	COUNTER # 7 = 0000
24.	COMB. # 8 = NOT IN USE	COUNTER # 8 = 0000
25.	COMB. # 9 = NOT IN USE	COUNTER # 9 = 0000
26.	FORMAT = NORMAL	
27.	DISPLAY = NORMAL	
28.	BAUDRATE = 300	

8.4.3 Format when Programming

```
u   =       space
CR  =       carriage return
LF  =       line feed

1)  CR LF DATE u = u 1982-03-12 CR LF
          uuuu u u u
2)  CR LF TIME u = u 08:58 CR LF
          uuuu u u u
```

```
 3)  CR LF START u OF u MEASUREMENT u = u 09:00 CR LF
         uuuuu u uu u uuuuuuuuuuu u u u
 4)  CR LF END u OF u MEASUREMENT u = u 10:30 CR LF
         uuu u uu u uuuuuuuuuuu u u u
 5)  CR LF CRIT. u # u 0 u = u F1 u A2454211 CR LF
         uuuu  u u u u u u u
 6)  CR LF CRIT. u # u 1 u = u F1 u F CR LF
         uuuu  u u u u u u u
 7)  CR LF CRIT. u # u 2 u = u F2 u 1 CR LF
         uuuu  u u u u u u u
 8)  CR LF CRIT. u # u 3 u = u F3 u 46 CR LF
         uuuu  u u u u u u u
 9)  CR LF CRIT. u # u 4 u = u BA u 4 CR LF
         uuuu  u u u u u u u
10)  CR LF CRIT. u # u 5 u = u BB u 4 CR LF
         uuuu  u u u u u u u
11)  CR LF CRIT. u # u 6 u = u B3 u 10 CR LF
         uuuu  u u u u u u u
12)  CR LF CRIT. u # u 7 u = u MX u 316 CR LF
         uuuu  u u u u u u u
13)  CR LF CRIT. u # u 8 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u
14)  CR LF CRIT. u # u 9 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u
15)  CR LF COMB. u # u 0 u = u 0 CR LF
         uuuu  u u u u u u u
16)  CR LF COMB. u # u 1 u = u 3,6 CR LF
         uuuu  u u u u u u u
17)  CR LF COMB. u # u 2 u = u o,2,7CR LF
         uuuu  u u u u u u u
18)  CR LF COMB. u # u 3 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u
19)  CR LF COMB. u # u 4 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u
20)  CR LF COMB. u # u 5 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u
21)  CR LF COMB. u # u 6 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u
22)  CR LF COMB. u # u 7 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u
23)  CR LF COMB. u # u 8 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u

24)  CR LF COMB. u # u 9 u = u NOT u IN u USE CR LF
         uuuu  u u u u u u u
25)  CR LF FORMAT u = u NORMAL uuuu CR LF
         uuuuuu u u u
26)  CR LF DISPLAY u = u NORMAL CR LF
         uuuuuuu u u u
27)  CR LF BAUDRATE u = u 1200 CR LF
         uuuuuuuu u u u
28)  CR LF READY CR LF

29)  CR LF CR LF BL CR LF (a "BEEP" is heard)
```

If the programming data have contained an error, the line will be sent again with an "#" on a line of its own.

Thus, if there was an error in line No. 2, it will be sent again in the following form:

```
2)   CR LF "#" CR LF
            T I M Eu = u 0 8 : 5 8 CR LF
            u u u uu u u
```

8.5 TRANSMISSION TO THE MFC DISPLAY

Data for the MFC DISPLAY are transmitted without any form of format - but as individual characters.

ACK/NAK

These control characters are used only if SW1-2 is OPEN and only when transmitting status and calls.

S/P

The MFC DISPLAY may at any time receive an "S" or a "P". An "S" causes the MFC DISPLAY to send status print-out, see 8.4.2. A "P" causes the MFC DISPLAY to go into programming mode, see 8.4.3.

In the programming mode the following additional characters may be received:

"DEL" a) Delete last received character and transmit "BS" (as single character)

b) If there are no more characters to delete, "BEL" is transmitted as a single character.

"CR" Complete programming of this line. This causes the same line to be sent if there is an error in the programming, or the next line to be sent if the programming is O.K.

"ESC" Causes the first line of the next block to be sent. If it is the last block, READY is sent.

"G" "O" Programming stops and measuring starts.

8.6 STOP AND RESET CRITERIA

8.6.1 Stop

When the instrument goes into a Stop condition, the result is that it no longer responds to the MFC signals applied, and at the same time the connection via the V.24 interface is cut. The Stop condition is indicated by a stop lamp.

The Stop condition will be cancelled when the MAN reset switch is operated or when an external reset pulse is applied. Furthermore, a new transmission may be requested by placing CT 125 to ON, followed by either CT 122 or CT 109 or simply by placing CT 122 or CT 109 to ON.

EXTERNAL STOP: After a condition corresponding to Vin < 10V has prevailed for more than 10 ms, the condition Vin > 24V for 10 ms will cause the instrument to go to Stop.
Maximum voltage: 70V (continuous): 1,000V peak at an average output of 0.5 Watts.

MANUAL STOP: The Shift switch also has the function of causing a Stop; this switch is disabled, however, when the V.24 output is enabled.

AUTOMATIC STOP on specific digits does not occur.

8.6.2 Reset

Reset is used for initialization of the instrument so that it is prepared to receive a new MFC call.

After the respective CT lines in the V.24 interface have been set to ON, so that the instrument is ready to transmit, the instrument waits for a reset to synchronize the MFC calls to the start of a call. Resets following after that will be used as separating signals between the individual data blocks, and in addition the Display itself will be reset.

EXTERNAL RESET: After a condition corresponding to Vin < 10V has prevailed for more than 10 ms, the condition Vin > 24V for 10 ms will cause the instrument to reset.
Maximum voltage: 70V (continuous): 1,000V peak at an average output of 0.5 Watts.

MANUAL RESET: Resetting is performed by activating the switch.

AUTOMATIC RESET on specific digits with the Reset switch in the AUT position:

a) With a delay of 250 ms after the digits A4/B4 or A15/B15 have been received.

b) With a delay of 250 ms after receipt of a backward signal where the previous signal was A3.

c) With a delay of 250 ms after receipt of the digit A6/B6; this function may be disabled, however.

AUTOMATIC RESET on specific events during the transmission:

If the instrument has received more than 31 digits (overflow) and is not reset in any other way, resetting will occur after 5 seconds.

8.7 CONNECTION AND TRANSMISSION AT THE VARIOUS TRANSMISSION POSSIBILITIES

The selection of the ten transmission possibilities is determined by (1) the operation of the small switches, (2) the CT lines that go to ON, and (3) the order in which this occurs.

For further details on transmission and criteria for connection and disconnection, see "Introduction" (8.1 above), "Stop and Reset Criteria" (8.6 above), "Functions behind the Front Panel" (2.4 above), and "Summary of Transmission Possibilities" (8.8.2 below).

8.7.1 Transmission Possibilities

1. Connection by Call

SW3-2: OPEN
1,200 baud simplex with backward channel for 75 baud with ACK/NAK.

a) MFC-D waits for CT 125 followed by CT 122 to go to ON (CT109 off)
b) CT 125 and CT 122 go to ON.
c) MFC-D sets CT 105 and CT 108 to ON and CT 111 to 1,200 baud.
d) Wait until CT 106, CT 107, and CT 122 are all ON.
Wait for 1 second.
e) Wait for RESET (external, manual or automatic).
f) MFC-D transmits 1st block.
g1) MFC-D receives ACK.
g2) MFC-D receives NAK.
h1) MFC-D transmits 2nd block.
h2) MFC-D transmits 1st block.

etc.

etc.

2. Fixed Connection

SW3-2: OPEN
1,200 baud simplex with backward channel for 75 baud with ACK/NAK.

a) MFC-D waits for CT 122 to go to ON (CT 125 and CT 109 OFF).
b) CT 122 goes to ON.
c) MFC-D sets CT 105 and CT 108 to ON and CT 111 to 1,200 baud.
d) Wait until CT 106, CT 107, and CT 122 are all ON.
Wait for 1 second.
e) Wait for RESET (external, manual or automatic).
f) MFC-D transmits 1st block.
g1) MFC-D receives ACK.
g2) MFC-D receives NAK.
h1) MFC-D transmits 2nd block.
h2) MFC-D transmits 1st block.

etc.

etc.

3. Connection at Call

SW3-2: OPEN
1,200 baud simplex without ACK/NAK (with backward channel carrier).

a) MFC-D waits for CT 125 followed by CT 122 to go to ON (CT 109 OFF).
b) CT 125 and CT 122 go to ON.
c) MFC-D sets CT 105 and CT 108 to ON and CT 111 to 1,200 baud.

d) Wait until CT 106, CT 107, and CT 122 are all ON.
   Wait for 1 second.
e) Wait for RESET (external, manual or automatic).
f) MFC-D transmits 1st block.
g) MFC-D transmits 2nd block.

etc.

etc.

4. Fixed Connection

SW3-2: OPEN
1,200 baud simplex without ACK/NAK (with backward channel carrier).

a) MFC-D waits for CT 122 to go to ON (CT 125 and CT 109 OFF).
b) CT 122 goes to ON.
c) MFC-D sets CT 105 and CT 108 to ON and CT 111 to 1,200 baud.
d) Wait until CT 106, CT 107, and CT 122 are all ON.
   Wait for 1 second.
e) Wait for RESET (external, manual or automatic).
f) MFC-D transmits 1st block.
g) MFC-D transmits 2nd block.

5. Fixed Connection

SW3-2: OPEN
1,200 baud full duplex with ACK/NAK
a) MFC-D waits for CT 109 to go to ON (CT 125 and CT 122 OFF).
b) CT 109 goes to ON.
c) MFC-D sets CT 105 and CT 108 to ON and CT 111 to 1,200 baud.
d) Wait until CT 106, CT 107, and CT 109 are all ON.
   Wait for 1 second.
e) Wait for RESET (external, manual or automatic).
f) MFC-D transmits 1st block.
g1) MFC-D receives ACK.
g2) MFC-D receives NAK.
h1) MFC-D transmits 2nd block.
h2) MFC-D transmits 1st block.

etc.

etc.

6. Fixed connection

SW3-2: OPEN
1,200 baud full duplex without ACK/NAK ("1,200 baud simplex w/ CT 109")

a) MFC-D waits for CT 109 to go to ON (CT 125 and CT 122 OFF).
b) CT 109 goes to ON.
c) MFC-D sets CT 105 and CT 108 to ON and CT 111 to 1,200 baud.
d) Wait until CT 106, CT 107, and CT 109 are all ON.
   Wait for 1 second.
e) Wait for RESET (external, manual or automatic).
f) MFC-D transmits 1st block.
g) MFC-D transmits 2nd block.

etc.

etc.

7. Connection at Call

SW3-2: CLOSED SW3-3: OPEN
300 baud full duplex with ACK/NAK

a) MFC-D waits for CT 125 to go to ON.
b) CT 125 goes to ON.
c) MFC-D sets CT 105 and CT 108 to ON and CT 126 to ON.
d) Wait until CT 106, CT 107, and CT 109 are all ON.
   Wait for 1 second.
e) Wait for RESET (external, manual or automatic).
f) MFC-D transmits 1st block.
g1) MFC-D receives ACK.
g2) MFC-D receives NAK.
h1) MFC-D transmits 2nd block.
h2) MFC-D transmits 1st block.

etc.

etc.

8. Connection at Call

SW3-2: CLOSED SW3-3: OPEN
300 baud full duplex without ACK/NAK.

a) MFC-D waits for CT 125 to go to ON.

b) CT 125 goes to ON.
c) MFC-D sets CT 105 and CT 108 to ON and CT 126 to ON.
d) Wait until CT 106, CT 107, and CT 109 are all ON.
Wait for 1 second.
e) Wait for RESET (external, manual or automatic).
f) MFC-D transmits 1st block.
g) MFC-D transmits 2nd block.

etc.

etc.

9. Connection Prepared by MFC-D

SW3-2: CLOSED SW3-3: CLOSED
300 baud full duplex with ACK/NAK.

a) MFC-D sets CT 105 and CT 108 to ON and CT 126 to OFF.
b) Wait until CT 106, CT 107, and CT 109 are all ON.
c) Wait for RESET (external, manual or automatic).
d) MFC-D transmits 1st block.
Wait for 1 second.
e1) MFC-D receives ACK.
e2) MFC-D receives NAK.
f1) MFC-D transmits 2nd block.
f2) MFC-D transmits 1st block.

etc.

etc.

10 Connection Prepared by MFC-D

SW3-2: CLOSED SW3-3: CLOSED
300 baud full duplex without ACK/NAK.

a) MFC-D sets CT 105 and CT 108 to ON and CT 126 to OFF.
b) Wait until CT 106, CT 107, and CT 109 are all ON.
c) Wait for RESET (external, manual or automatic).
d) MFC-D transmits 1st block.
Wait for 1 second.
e) MFC-D transmits 2nd block.

etc.

8.8 SURVEY OF TRANSMISSION POSSIBILITIES

POSSIBILITIES	DATA TRANSMISSION	BAUD RATE	CHANNEL FOR ANSWER	CRITERION FOR CONNECTION	CRITERION FOR DISCONNECTION
1	SIMPLEX with ACK/NAK - WHEN CALLING (SWITCHED)	1200 BAUD/75 BAUD	CT 119	CT 125 - CT 122: ON	CT 107 or CT 122: OFF, STOP condition, ACK/NAK missing on three subsequent blocks
2	SIMPLEX with ACK/NAK - FIXED CONNECTION (NON-SWITCHED)	1200 BAUD/75 BAUD	CT 119	CT 122: ON	CT 107 or CT 122: OFF, STOP condition, ACK/NAK missing on three subsequent blocks
3	SIMPLEX w/o ACK/NAK - WHEN CALLING (SWITCHED)	1200 BAUD/ -	—	CT 125 - CT 122: ON	CT 107 or CT 122: OFF, STOP condition
4	SIMPLEX w/o ACK/NAK - FIXED CONNECTION (NON-SWITCHED)	1200 BAUD/ -	—	CT 122: ON	CT 107 or CT 122: OFF, STOP condition
5	FULL DUPLEX with ACK/NAK - FIXED CONNECTION (NON-SWITCHED)	1200 BAUD/1200 BAUD	CT 104	CT 109: ON	CT 107 or CT 109: OFF, STOP condition ACK/NAK missing on 3 subsequent blocks
6	FULL DUPLEX w/o ACK/NAK - FIXED CONNECTION (NON SWITCHED)	1200 BAUD/ -	—	CT 109: ON	CT 107 or CT 122: OFF, STOP condition
7	FULL DUPLEX with ACK/NAK - WHEN CALLING (SWITCHED)	300 BAUD/300 BAUD	CT 104	CT 125 - CT 109: ON	CT 107 or CT 109: OFF, STOP CONDITION, ACK/NAK missing on 3 subsequent blocks
8	FULL DUPLEX w/o ACK/NAK - WHEN CALLING (SWITCHED)	300 BAUD/ -	—	CT 125 - CT 109: ON	CT 107 or CT 109: OFF, STOP condition
9	FULL DUPLEX with ACK/NAK - FOR TERMINAL/ TAPE RECORDER	300 BAUD/300 BAUD	CT 104	CT 108/2-CT 105 ON & CT 126 OFF: WAIT FOR CT 106, CT 107, CT 109 ON	CT 107 or CT 109: OFF, STOP condition, ACK/NAK missing on three subsequent blocks
10	FULL DUPLEX w/o ACK/NAK - FOR TERMINAL TAPERECORDER	300 BAUD/ -		CT 108/2-CT 105 ON & CT 126 OFF WAIT FOR: CT 106, CT 107, CT 109 ON	CT 107 or CT 109: OFF, STOP condition
	Connection to local terminal or tape recorder is made by selecting between 1-10, at the same time as the real CT-lines are set to ON outside the MFC DISPLAY. This may also be done by correct connections in the connector.				

TABLE OF TRANSMISSIONS AND THE CT LINES EMPLOYED

POSSIBILITIES	CT 102	CT 103	CT 104	CT 105	CT 106	CT 107	CT 108	CT 109	CT 111	CT 119	CT 122	CT 125	CT 126
1	X	X		X	X	X	X		X	X	X	X	
2	X	X		X	X	X	X		X	X	X		
3	X	X		X	X	X	X		X		X	X	
4	X	X		X	X	X	X		X		X		
5	X	X	X	X	X	X	X	X	X				
6	X	X		X	X	X	X	X	X				
7	X	X	X	X	X	X	X	X				X	X
8	X	X		X	X	X	X	X				X	X
9	X	X	X	X	X	X	X	X					X
10	X	X		X	X	X	X	X					X

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8.9.1 Criteria for Connection and Disconnection

1,200 baud Connection

If CT 125 goes to ON and neither CT 109 nor CT 122 go to ON, the CT 125 ON is disregarded.

1,200 baud Disconnection/Stop Transmission

After connection with CT 109 or CT 122 the system waits for 30 seconds for CT 106 and CT 107 to go ON. If this does not occur, disconnection will result.
After connection with CT 109, disconnection will occur if either CT 107 or CT 109 goes to OFF for an uninterrupted period of 50 ms.
After connection with CT 122, disconnection will occur if either CT 107 or CT 122 goes to OFF for an uninterrupted period of 50 ms. Transmission will stop if CT 106 goes to OFF.

1,200 baud Disconnection/Connection

After disconnection, wait for 5 secs. before attempting reconnection.

300 baud Disconnection/Stop Transmission

After CT 125 ON the system waits for 30 secs. for CT 106, CT 107 and CT 109 to go to ON. If this does not occur, disconnection will result.
After connection, disconnection will occur if either CT 107 or CT 109 goes to OFF for an uninterrupted period of 50 ms. Transmission will stop if CT 106 goes to OFF.

300 baud Disconnection/Connection

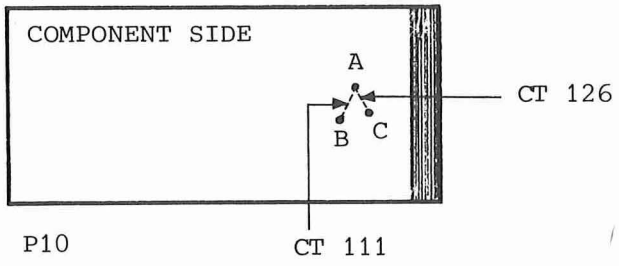
After disconnection, wait for 5 secs. before attempting reconnection.

8.9.2 Selection of baud Rate

The baud rate must be selected before the instrument is switched on.

As supplied from ELMI the instrument is prepared for a 1,200 baud transmission rate, and CT 111 operates accordingly.

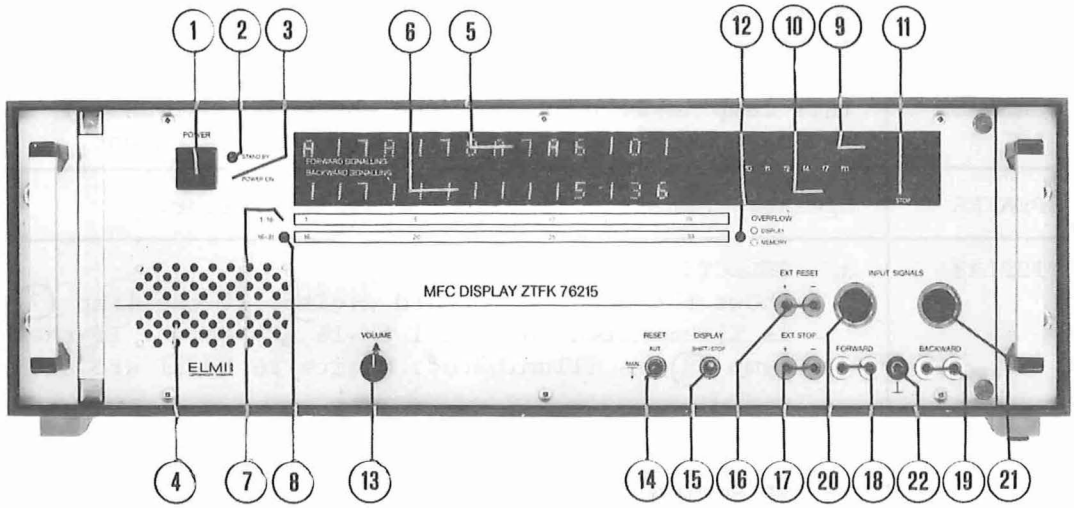
If a 300 baud transmission rate is preferred, conversion is made by setting the appropriate switches. However, if CT 126 is also to function in accordance with the diagrams, it is necessary to shift the strap installed between "A" and "B" on the P10 - V.24 PRINTER INTERFACE print so that it is located between "A" and "C".



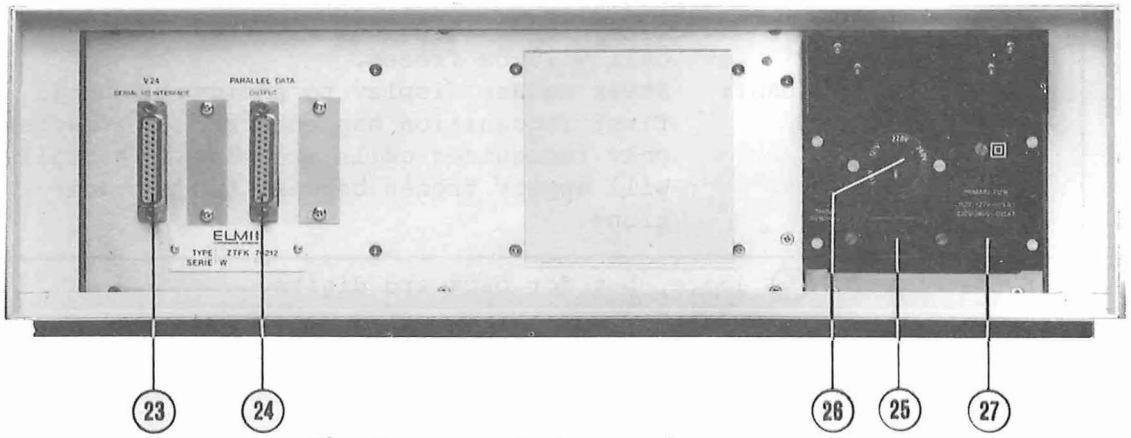
9. CORRECTIONS/ADDITIONS TO THE ORIGINAL MANUAL

9.1 FUNCTIONAL DESCRIPTION

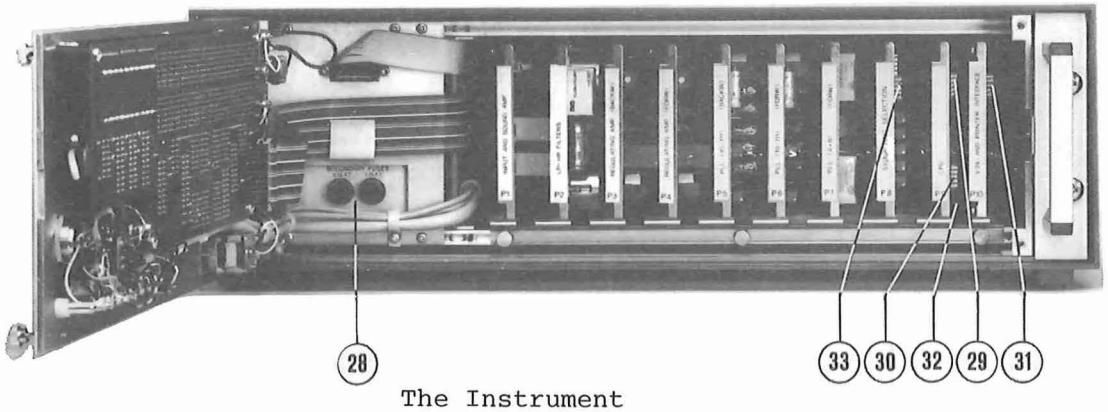
9.1.1 General Views.



The Instrument (front view)



The Instrument (rear view)



The Instrument
(front view with open panel)

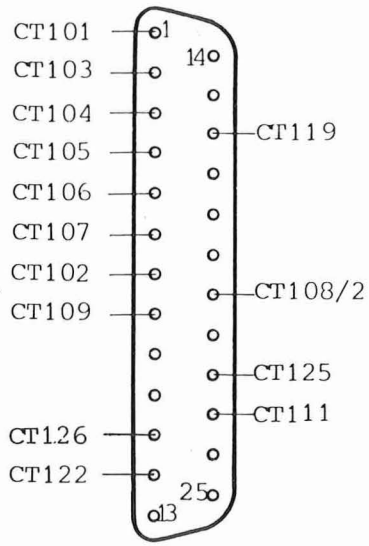
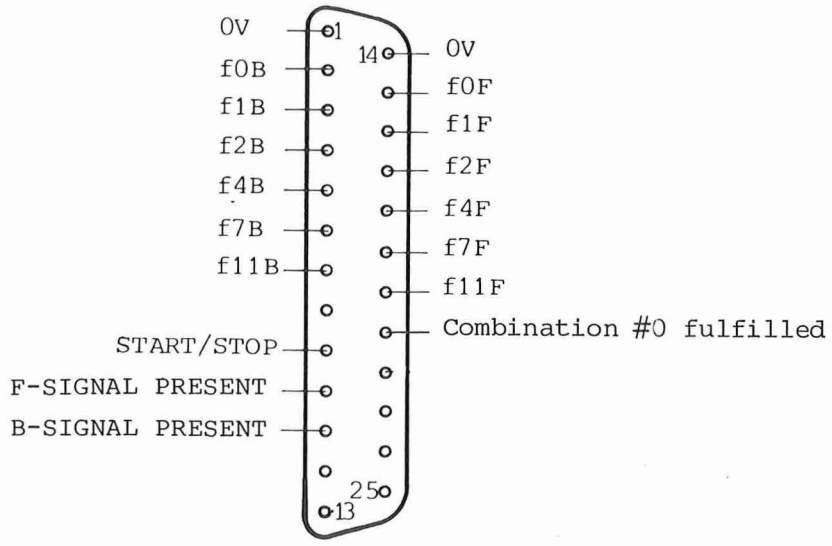
9.1.2 Front Panel Functions

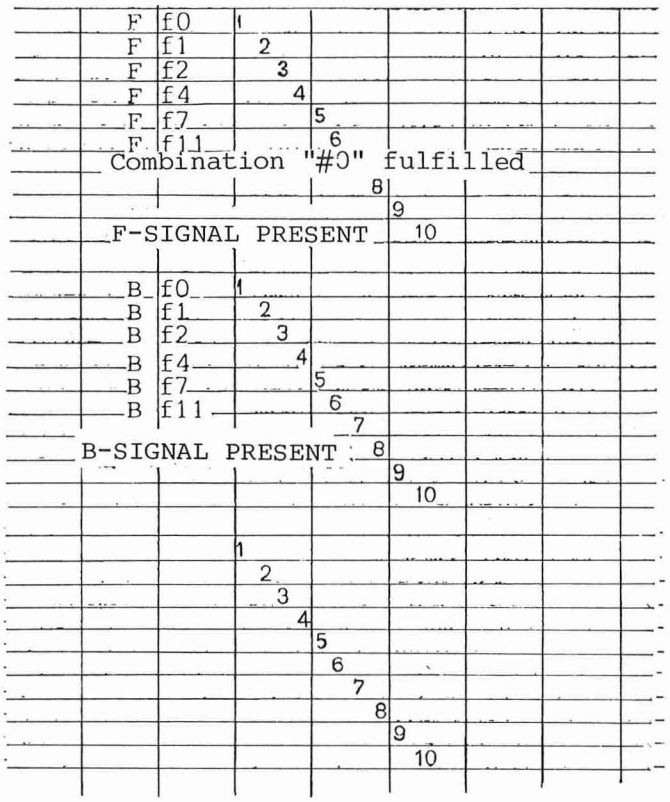
(1)	POWER	Switches instrument ON and OFF.
(2)	STAND BY	If voltage is connected to the instrument but the POWER SWITCH (1) has not been activated, this lamp comes on.
(3)	POWER ON LAMP	This lamp is illuminated when the POWER SWITCH (1) is activated and power is applied to the instrument.
(4)	SPEAKER	Speaker connected to the integral amplifier.
(5)	DISPLAY	a/ SELECTION NOT ACTIVE Shows the decoded forward digits. If the lamp (7) is illuminated, digits 1 to 16 are shown. If the lamp (8) is illuminated, digits 16 to 31 are seen. Reset causes the display to extinguish. b/ SELECTION ACTIVE As under a/, but with the following addition: When selection is active, the following display modes are available: NORMAL: Reset extinguishes display. FIRST: Reset causes display to extinguish until first recognition has occurred. Then this call will be frozen. LAST: Reset causes display to extinguish until first recognition has occurred. Thereafter only recognized calls are shown. The calls will appear frozen between two recognitions.
(6)	DISPLAY	As (5) above, but for backward digits.
(7)	LAMP 1-16	The lamp goes on if the display indicates positions 1 to 16. When used without selection active or with selection where the display is used as NORMAL: The lamp blinks if - during input of these digits - too many frequencies were present so that it was impossible to decode the relevant signal. SELECTION WITH "FIRST" OR "LAST" CHOSEN: The lamp blinks if - during decoding of new digits - too many frequencies are present so that it is impossible to decode the relevant signal.
(8)	LAMP 16-31	As (7) above, but for positions 16 to 31.

9	LAMPS (f0-f11)	Each lamp represents a forward frequency. If one or more of these frequencies are present at the input at this particular time, the lamp(s) will illuminate. There are 6 lamps (f0-f1-f2-f4-f7-f11), each of which lights up for 1,380Hz, 1,500Hz, 1,670Hz, 1,740Hz, 1,860 Hz, and 1,980Hz, respectively. The lamps will remain on if a STOP condition has intervened.
10	LAMPS (f0-f11)	Each lamp represents a backward frequency. If one or more of these frequencies are present at the input at this particular time, the lamp(s) will illuminate. There are 6 lamps (f0-f1-f2-f4-f7-f11), each of which lights up for 1,140Hz, 1,020Hz, 900Hz, 780Hz, 600Hz, and 540Hz, respectively. The lamps will remain on if a STOP condition has intervened.
11	LAMP (STOP)	This STOP lamp illuminates if the instrument is in a STOP Mode. It indicates that the instrument no longer records and decodes the applied signals.
12	LAMP (OVERFLOW)	This lamp illuminates if there is overflow in the display, i.e. the next approved digits will be stored in the memory. If the lamp flashes, it indicates that all signals applied from now on will be lost (Memory Overflow). If selection is active and the display used to freeze the last or first approved call, the lamp will not illuminate or flash as a function of the call being decoded at this particular moment. On the other hand, the lamp will be extinguished if the first call can be accommodated in the display, and illuminated if there are additional digits in the memory.
13	VOLUME	Adjusts the volume of the integral amplifier.
14	RESET SW.	MAN RESET: Resets the instrument when operated and prepares it for a new call. If V.24 is activated, the first reset will be employed as a synchronizing signal and the following ones as "END OF DATA BLOCK". If selection is active and the display is used to freeze the first or the last call, a Reset will trigger the freezing if the call is approved. At the same time, the signal in the parallel output which indicates that the combination #0 has been fulfilled, will be reset. AUTOMATIC RESET: Specific events/signal combinations will trigger a reset function along the lines described under Manual Reset, but it will not cause a resetting of the output indicating whether the combination #0 is fulfilled.

(15)	DISPLAY SHIFT/STOP	WITHOUT V.24. Operating this switch will cause a display of the signals 1-16 or 16-31 to be shown; this will occur as often as the SWITCH is actuated. The SWITCH also incorporates a MANUAL STOP FUNCTION, as it causes the instrument to go into STOP the first time it is actuated. WITH V.24. In this case the SWITCH has no function unless, at the same time, selection is active and the display is used to freeze the first or the last call. If so, it is possible to alternate between the positions 1-16 and 16-31 after freezing has occurred. The manual Stop Function remains inoperative.
(16)	EXTERNAL RESET	If a condition corresponding to Vin < 10V has prevailed for more than 10 ms, a condition of Vin > 24V for 10 ms will trigger a resetting as described under (14) above (MAN RESET).
(17)	EXTERNAL STOP	If a condition corresponding to Vin < 10V has prevailed for more than 10 ms, a condition of Vin > 24V for 10 ms will cause the instrument to go to the STOP MODE.
(18)	FORWARD INPUT	Input jacks for forward signals in 4-wire communication. For 2-wire communication the input jacks should be connectied to the input jacks in (19) (right to right and left to left).
(19)	BACKWARD INPUT	As (18) above, except: read backward instead of forward.
(20)	INPUT JACK	PINS 1 & 3 correspond to the input jacks in (18) . PIN 2 is 0V.
(21)	INPUT JACK	PINS 1 & 3 correspond to the input jacks in (19) . PIN 2 is 0V.
(22)	0V.	The instrument's 0V.

9.1.3 Rear Panel Functions

23	V.24 Serial I/O Interface	V.24 INTERFACE section  Connector seen from the outside *(CT 126): If this connection is needed, a strap must be shifted on the V.24 print. At the same time CT 111 will be inactive.
24	PARALLEL DATA OUTPUT	This OUTPUT may be used in connection with ELMI's Event Recorder, enabling the user to measure the duration of the signals.  Connector seen from the outside

		When the appropriate ELMI cable is used, the position of the signals will be as shown. 
25	MAINS CONNECTOR	
26	MAINS VOLTAGE SELECTOR	110V - 127V - 220V - 240V AC.
27	PRIMARY FUSE	Primary Fuse 110V and 127V 0.5 AT 220V and 240V 0.25 AT

9.1.4 Functions Behind the Front Panel

28 SECONDARY FUSES — Secondary Fuses 2 x 3.15 AT

SMALL PRINT-MOUNTED SWITCHES

29 SW1 (1-5)
30 SW2 (1-5)
31 SW3 (1-5)
33 SW4 (1-5)

The SWITCH is OPEN if it is away from the print - corresponding to the right when viewing the instrument from the front.
The SWITCH is CLOSED if it is positioned towards the print - corresponding to the left when viewing the instrument from the front.

FUNCTION SELECTION

29

SW1-1: OPEN: With V.24 CLOSED: Without V.24
SW1-2: OPEN: With ACK/NAK CLOSED: Without ACK/NAK
SW1-3: Selects between various Reset/Stop criteria (Table 9).
SW1-4: The OPEN-CLOSED-OPEN FUNCTION causes the WATCHDOG Lamp to extinguish.
SW1-5: Selects between various Reset/Stop criteria (Table 9).

30 MODE SELECTION

When the SWITCHES are OPEN, they are inoperative.
SW2-1: Connected to the processor but has no function.
SW2-2: Extended decoding time for backward signals containing the "f11" frequency : CLOSED
SW2-3: No Zeroes may be read out : CLOSED
SW2-4: Even though frequencies are present, it is regarded as a pause if the six tone receivers are all deactivated:
CLOSED
SW2-5: Do not read out an approved backward signal until the forward signal disappears : CLOSED

31 FUNCTION SELECTION

SW3-1: No connection
SW3-2: OPEN: 1,200 baud CLOSED: 300 baud
SW3-3: (300 baud only): OPEN : Calls up w/ CT 125.
CLOSED: Tries to connect.
SW3-4: OPEN: No function CLOSED: With "Speech Immunity".
SW3-5: Connected to the processor but has no function.

33 FUNCTION SELECTION

SW4-1: OPEN: When selecting by B-number, the backward group A signal "A2" has the meaning: n-1 (R2 meaning).
CLOSED When selecting by B-number, the backward group A signal "A2" has the meaning: restart (national).
SW4-2: Connected to the processor but has no meaning.
SW4-3: Connected to the processor but has no meaning.
SW4-4: Connected to the processor but has no meaning.
SW4-5: Connected to the processor but has no meaning.

(32) WATCHDOG LAMP

Lights up at POWER ON or errors in the execution of the program.
Can be turned off by SW1-4 (29) .

9.2 SURVEY OF STOP/RESET

①	②	③	④	⑤	⑥
SW1-1:CLOSED 3:OPEN 5:OPEN SW3-2:———— 3:————	SW1-1:CLOSED 3:OPEN 5:CLOSED SW3-2:———— 3:————	SW1-1:CLOSED 3:CLOSED 5:OPEN SW3-2:———— 3:————	SW1-1:CLOSED 3:CLOSED 5:CLOSED SW3-2:———— 3:————	SW1-1:OPEN 3:———— 5:OPEN SW3-2:———— 3:————	SW1-1:OPEN 3:———— 5:CLOSED SW3-2:———— 3:————
RESET: 1) MANUAL STOP RESET 300ms 2) AUTOMATIC A3/B3+1 A4/B4 A15/B15 } 3000ms 3) EXTERNAL STOP RESET 300ms 4) SPECIAL OVERFLOW 5000ms At shift to ③, ④, ⑤, or ⑥. DIRECT	RESET: 1) MANUAL STOP RESET 300ms 2) AUTOMATIC A3/B3+1 A4/B4 A15/B15 } 3000ms 3) EXTERNAL STOP RESET 300ms 4) SPECIAL OVERFLOW 5000ms At shift to ③, ④, ⑤, or ⑥. DIRECT	RESET: 1) MANUAL RESET 10ms READY FOR NEW RESET 10ms 2) AUTOMATIC A3/B3+1 A6/B6 } 900ms 3) EXTERNAL RESET 10ms READY FOR NEW RESET 10ms 4) SPECIAL OVERFLOW 5000ms At shift to ① or ②. DIRECT	RESET: 1) MANUAL RESET 10ms READY FOR NEW RESET 10ms 2) AUTOMATIC A3/B3+1 900ms 3) EXTERNAL RESET 10ms READY FOR NEW RESET 10ms 4) SPECIAL OVERFLOW 5000ms At shift to ① or ②. DIRECT	RESET: 1) MANUAL RESET 10ms READY FOR NEW RESET 10ms 2) AUTOMATIC A3/B3+1 A4/B4 A15/B15 A6/B6 } 250ms 3) EXTERNAL RESET 10ms READY FOR NEW RESET 10ms 4) SPECIAL OVERFLOW 5000ms At shift to ① or ②. DIRECT	RESET: 1) MANUAL RESET 10ms READY FOR NEW RESET 10ms 2) AUTOMATIC A3/B3+1 A4/B4 A15/B15 } 250ms 3) EXTERNAL RESET 10sm READY FOR NEW RESET 10ms 4) SPECIAL OVERFLOW 5000ms At shift to ① or ②. DIRECT
STOP: 1) MANUAL STOP SHIFT 10ms READY FOR NEW SHIFT 10ms 2) AUTOMATIC A6/B6 DIRECT 3) EXTERNAL 10ms STOP	STOP: 1) MANUAL STOP SHIFT 10ms READY FOR NEW SHIFT 10ms 3) EXTERNAL 10ms STOP	STOP: 1) MANUAL STOP SHIFT 10ms READY FOR NEW SHIFT 10ms 2) AUTOMATIC A4/B4 A15/B15 } DIRECT 3) EXTERNAL STOP 10ms READY FOR NEW STOP 10ms 4) SPECIAL AO/BO DIRECT	STOP: 1) MANUAL STOP SHIFT 10ms READY FOR NEW SHIFT 10ms 2) AUTOMATIC A4/B4 A15/B15 } DIRECT 3) EXTERNAL STOP 10ms READY FOR NEW STOP 10ms 4) SPECIAL AO/BO DIRECT	STOP: 3) EXTERNAL STOP 10sm READY FOR NEW STOP 10ms	STOP: 3) EXTERNAL STOP 10ms READY FOR NEW STOP 10ms

9.3 SW 3-4 SPEECH IMMUNITY

Active with SW3-4 Closed.

If the MFC DISPLAY is connected to the line where the MFC signalling as well as the speech are going on, the MFC DISPLAY will decode the speech to "MFC digits". The sequence of the false MFC digits will in most cases be so different from the true MFC call that it will be possible to screen them out. The screening is done by checking that the first digits are sensible and, if not, the call is "discarded".

The user of the MFC DISPLAY will see the decoded, false MFC digits on the display - followed immediately by an automatic Reset. The "call" will now neither be transmitted via the V.24 nor/and be handled by the selection program.

DEFINITION OF NON-SENSIBLE START DIGITS

1. If the first, second, or third forward or backward digit is Zero. (Zero means that nothing has been received or that it has been impossible to decode the signal).

2. If the first, second, or third backward digit is B, C, D, E, or F.

SW3-4 active cannot be used concurrently with SW2-3 (Zeroes are not allowed).

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OPTION ZYYK 15031

SCANNER

IMPORTANT

The option cannot operate together with the ZYYK 15010 option (V.24 and PRINTER INTERFACE). If ZYYK 15010 is nevertheless mounted, the Scanner will continue to operate correctly if no connection is established, or if the ZYYK 15010 is disabled (SW1-1).

If transmission via the V.24 interface is desired, the ZYYK 15005 option (signalling selection) must be mounted in addition to the ZYYK 15010 option.

10. SCANNER

10.1 INTRODUCTION

If the MFC Display is to be used in places where there is relatively little traffic, the measuring period can be better utilized by using the scanner module.

The Scanner increases the number of inputs from one to sixteen; however, only one of the sixteen channels is selectable at any one time.

10.2 SELECTING A CHANNEL

At the back of the MFC Display there are two 32-pole plugs containing channel 0-7 and channel 8-F, respectively. Mounting a single strap in each of these connectors will make it possible to select whether the Scanner is at all to be used, and whether channel 0-7, channel 8-F, or channel 0-F are to be active.

For each channel there is a control input indicating whether the wires or registers are seized.

Assuming that only channel 0-7 is used, and that channel 3 has been accepted (see the sketch in Fig. 10.1. - time a), the selection of a channel is performed in the following way:

TIME INTERVAL a-b

No matter what happens on the other control inputs, the registration will not be influenced. Only when the control input for channel 3 shifts to idle for a continuous period of 10 msec will the Scanner be ready for registration on a new channel, (b).

TIME b

Here it is approved that channel 3 has shifted to idle, thus rendering it possible to select a new channel. Only channels recorded as being idle and then shifting to busy for a coherent period of 10 msec will be accepted. For this reason the information on current idle channels is stored.

STATUS: Channels 1, 2, 3, 4, 5, 6 may come into consideration at this time.

TIME c

Now check whether some of the idle channels from b have changed to busy, thus perhaps being able to be accepted if they remain busy for a continuous period of 10 msec.

At the same time check whether some of the channels that were busy before have shifted to idle and for this reason also come into consideration the next time (in 2.5 msec).

If two channels at the same time comply with the demand for being accepted, the channel closest to the channel last accepted will be selected. This is to be understood in the sense that since channel 3 was active last, the priority for two or more channels being busy at the same time will be that channel 4 has first priority, followed by 5, 6, 7, 0, 1, 2, and channel 3 with the lowest priority.

STATUS: 1) This channel is selected if channel 2 remains busy for 10 msec.
2) Channel 1, 3, 4, 5, and 6 can still come into consideration.

TIME d

STATUS: 1) Channel 2 is accepted if it remains busy for 7.5 msec.
2) Channel 4 is accepted (highest priority) if channels 1 and 4 remain busy for 10 msec.
3) Channels 3, 5, and 6 may still come into consideration.

TIME e

STATUS: 1) Channel 2 is accepted if it remains busy for 5 msec.
2) Channel 4 (highest priority) is accepted if channels 1 and 4 remain busy for 7.5 msec.

3) Channel 5 is accepted if it remains busy for 10 msec.
4) Channels 3, 6, and 7 may come into consideration.

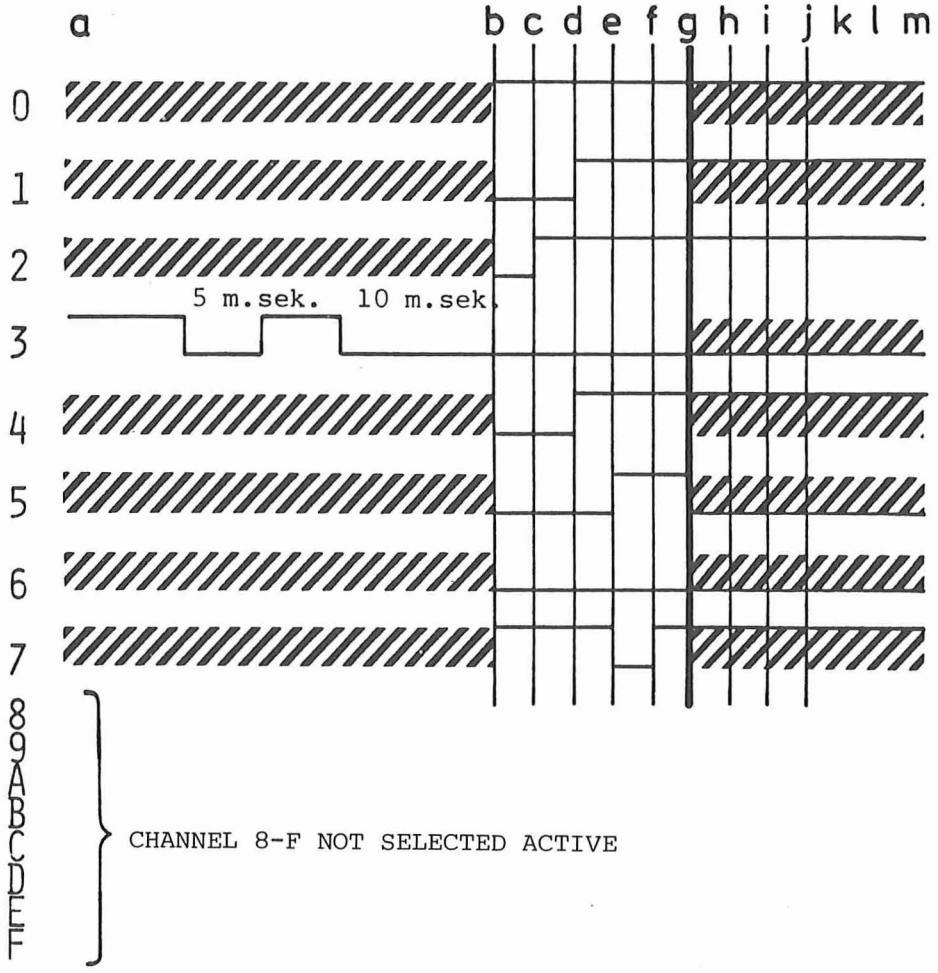
TIME f

STATUS: 1) Channel 2 is accepted the next time if it remains busy.
2) Channel 4 is accepted (highest priority) if channels 1 and 4 remain busy for 5 msec.
3) Channel 5 is accepted if it remains busy for 7.5 msec.
4) Channel 7 is accepted if it remains busy for 10 msec.
5) Channels 3 and 6 may come into consideration.

TIME g

Here channel 2 is accepted, which implies that the status of the other control inputs has no significance.

Fig. 10.1



Key to Fig. 10.1

1a) The time from a to b: random length

b) The time between the subsequent: 2.5 msec.

2a) The hatched section indicates that the control input is without significance.

b) : indicates a shift on the control input from idle to busy.

c) : indicates a shift on the control input from busy to idle.

10.3 REGISTRATION ON THE SELECTED CHANNEL

After a channel has been selected, the registration of the MFC call will start on the lines belonging to the control input.

If channel 2 is accepted, the forward signals are to enter the connector in pins 7c and 8c, and the associated backward signals are to enter in 7a and 8a. For 2-wire connection, 7a should be shortcircuited with 7c and 8a with 8c.

NB: When using the Scanner, the inputs on the front panel must not be used. See also: Scanner input terminals 34 and 35 for connections and Section 11.1 concerning transmission of data via the V.24 interface, for the presentation on the display itself and V.24 format.

If there is manual, automatic or external reset, the display will extinguish, and the instrument will be reset. Nothing else will occur until the control input goes idle.

If there has not been a reset, and the control input goes idle, an automatic reset will be triggered.

10.4 STRAPPING POSSIBILITIES

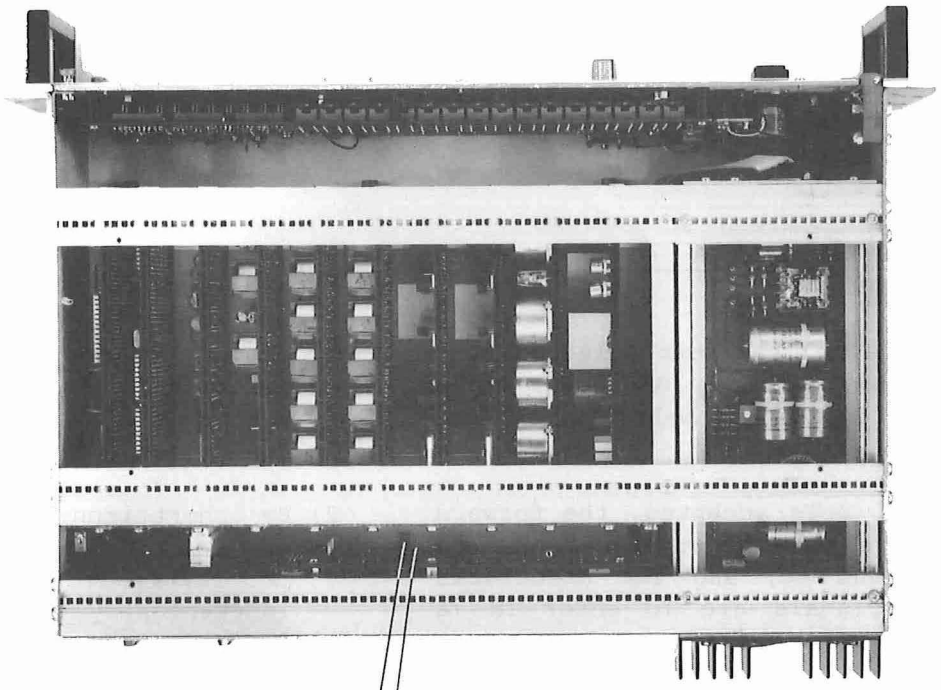
There are two shortcircuit possibilities in either of the two 32-pole plugs in the rear panel for channel 0-7 and channel 8-F.

1) By shortcircuiting terminals 24a and 25a, the 8 inputs in question are activated. This means that it is possible to activate the channels 0-7, 8-F, 0-F, or not use the Scanner at all.

2) By shortcircuiting terminals 26a and 24a, the polarity for busy can be reversed. This can be done independently in the two plugs, if desired. If the shortcircuit is established, it means that a busy control input is obtained if the voltage on the control input is greater than the reference voltage (more positive).

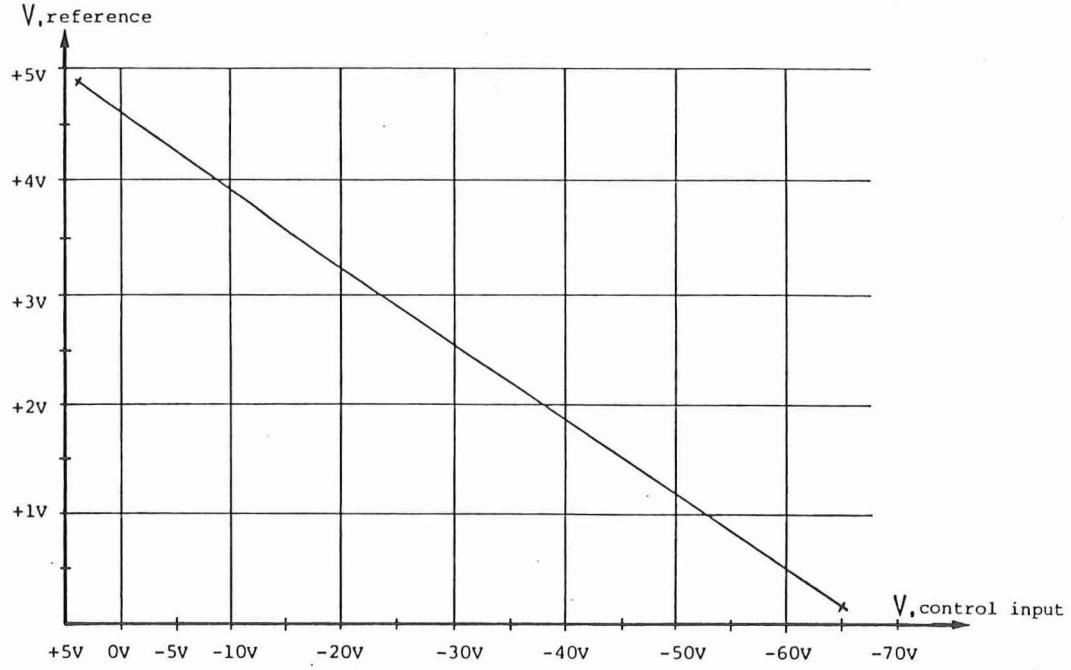
10.5 REFERENCE VOLTAGE

Upon delivery from ELMI A/S, the reference voltage is set to -19V.



If another voltage is desired, it is comparatively easy to set it by removing the instrument from its chassis and perform adjustment at the back of the scanner board. Apply the desired reference voltages to one of the control inputs and turn the potentiometer until the relay is just deenergized (opens). This can also be done by measuring the voltage on the test pin positioned beside the potentiometer and then perform adjustment until the desired voltage is reached, in accordance with the graph below.

CONVERSION OF REFERENCE VOLTAGE TO VOLTAGE ON CONTROL INPUT



The graph shows the connection between a set reference voltage and the corresponding voltage on the control input at which the change between idle and busy takes place.

The accuracy depends upon resistance tolerances and voltage tolerances, for which reason the graph can be used as an excellent guideline, although slight deviations may occur.

10.6 SCANNER AND SELECTION ACTIVE SIMULTANEOUSLY

If the Scanner is used at the same time as the selection is active, the criteria entered will apply to all 16 channels.

11. OUTPUT VIA THE V.24 INTERFACE

This is only possible if the options ZYYK 15005 and ZYYK 15010 are mounted.

The description in Section 8 of the V.24 interface in connection with the selector also applies when the Scanner is active, however with the following deviations.

11.1 TRANSMITTED DATA VIA THE V.24 INTERFACE

Three categories of data are transmitted via the V.24 interface, viz. decoded calls, status printout and programming data.

11.1.1 FORMAT IN CONNECTION WITH CALLS

If channel No. 10 has been accepted, the display will show:

F:	B		4	5	4	2	1	1	1						
B:	0		1	1	1	1	1	3	6						
	1				5						10				15
	16				20						25				30

When FORMAT = NORMAL, the following is transmitted:

STX	RS	NUL	NUL	1	0	:	3	2	␣	␣	NUL	B	CR	LF	RS
F	:	␣	4	5	4	2	1	1	1	CR	LF				
B	:	␣	1	1	1	1	1	3	6						
ETX	BCC	CR	LF												

Key to the transmitted characters:

STX	: Start of text
RS	: Separator
NUL, NUL	: Dummy characters
10:32	: Time for registration of calls (hours:minutes)
␣	: Space (in the case of retransmission, 'space' is replaced by 'R')
␣,NUL,B	: Space, Dummy character, B corresponding to channel 12)
CR-LF	: Carriage Return - Line Feed
RS	: Separator
F:␣	: Forward, colon, space
4542111	: Forward, decoded digits
CR - LF	: Carriage Return - Line Feed
B:␣	: B(backward), colon, space
1111136	: Backward, decoded digits
ETX	: End of text
BCC	: Block Check Character: "Exclusive-OR" of STX up to and including ETX. The character is cancelled by retransmission without the use of ACK/NAK.
CR-LF	: Carriage Return - Line Feed

When FORMAT = COMPRESSED, the following is transmitted:

STX	RS	NUL	NUL	1	0	:	3	2	␣	␣	NUL	B	CR	LF	RS									
B	-	N	U	M	B	E	R	:	␣	4	5	4	2	1	1	␣	A	2	␣	=	␣	0	0	
ETX	BCC	CR	LF																					

Key to the transmitted characters:

STX	: Start of text
RS	: Separator
NUL ,NUL	: Dummy characters
10:32	: Time of registration of the calls (hours:minutes)
␣	: Space (in the case of a retransmission, 'space' is replaced by 'R')
␣ , NUL,B	: Space, dummy character, B equal to channel 12
CR-LF	: Carriage Return - Line Feed
RS	: Separator
B-number:␣	The word B-number, colon, space
454211:	: The decoded 'B-number'
␣A2␣=␣	: Space, A2, space, = , space
00	: The number of decoded backward signals that was equal to A2
ETX	: End of text
BCC	: Block Check Character: 'Exclusive-OR' of STX up to and including ETX. The character is cancelled by retransmission without the use of ACK/NAK
CR-LF	: Carriage Return - Line Feed

11.2 STOP AND RESET CRITERIA

11.2.1 STOP

When the instrument goes into a stop condition, the result is that it no longer responds to the MFC signals applied, and at the same time the connection via the V.24 interface is cut. The Stop condition is indicated by a stop lamp.

The Stop condition will be cancelled by a RESET (manual, automatic, or external), by connecting the V.24 interface, or when the control input for an accepted channel goes to idle.

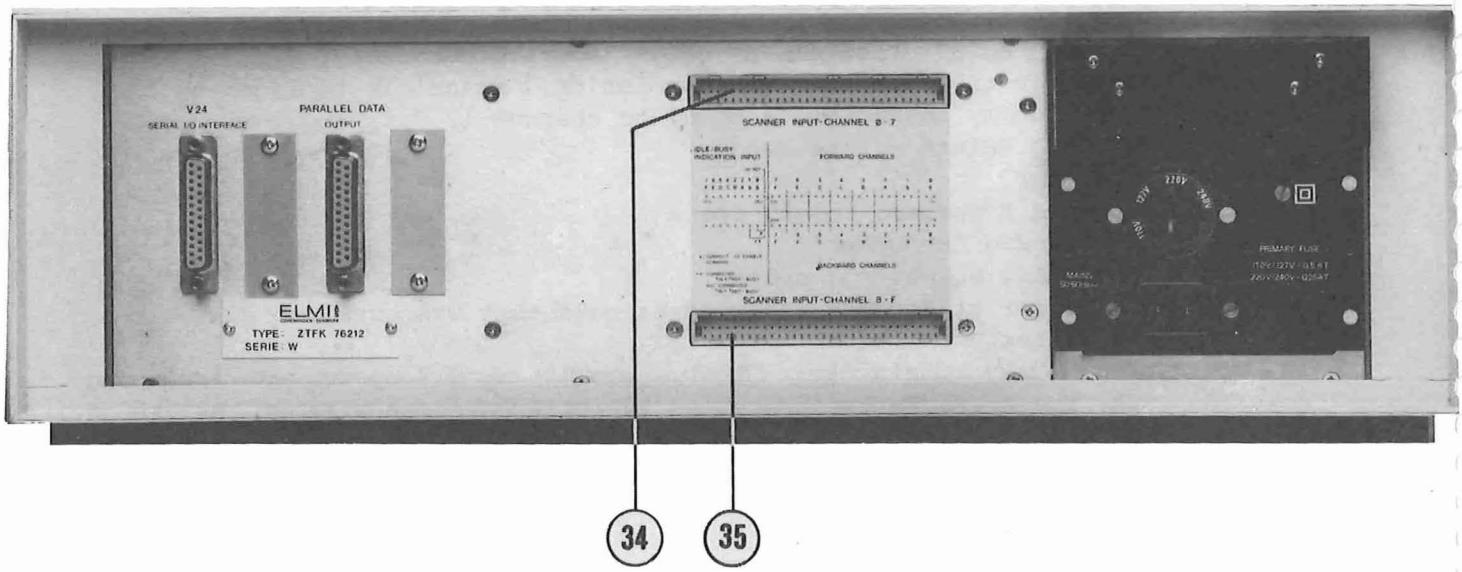
EXTERNÀL STOP: After a condition corresponding to $V_{in} < 10V$ has prevailed for more than 10 ms, the condition $V_{in} > 24$ V for 10 ms causes the instrument to go to Stop.

Maximum voltage: 70V (continuous) (1,000V peak at an average output of 0.5W).

MANUAL STOP: The Shift switch also has the function of causing a Stop condition; this switch is disabled, however, when the V.24 output is enabled.

AUTOMATIC STOP: Automatic stop on specific digits does not occur.

12. CHANGES/ADDITIONS TO FUNCTION/OPERATION AT SCANNER ACTIVE



THE INSTRUMENT SEEN FROM THE REAR

12.1 THE DISPLAY 5 and 6

The first forward position shows the channel number 0-F, while the associated backward position shows a 0. Position number 2 will be extinguished, and position 3,4 etc. will now show the decoded signals.

12.2 RESET, SWITCH 14

There will be no additional registration until the control input becomes idle and a new one, or the same, becomes busy.

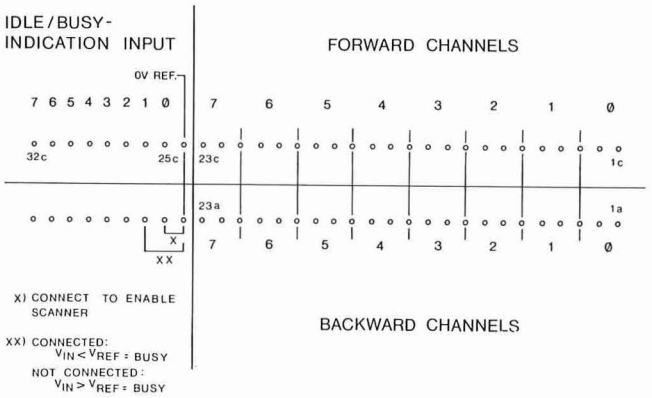
12.3 FORWARD INPUT AND BACKWARD INPUT 18, 19

The input terminal **SHOULD NEVER** be used when the Scanner is activated.

12.4 THE SCANNER INPUT TERMINALS

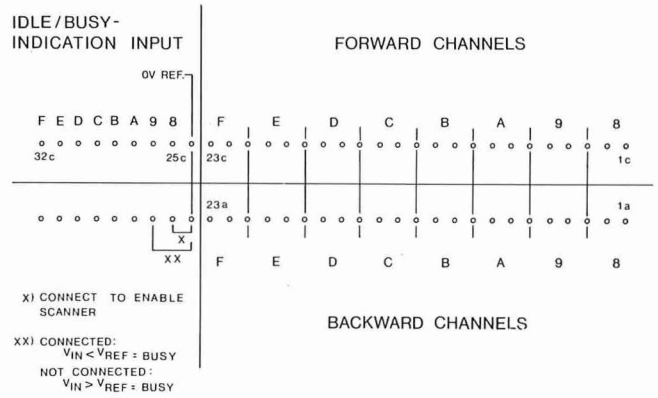
(34) SCANNER INPUT CHANNEL Ø-7

SCANNER INPUT-CHANNEL Ø - 7



(35) SCANNER INPUT CHANNEL 8-F

SCANNER INPUT-CHANNEL 8 - F



a/ Connect the right forward bushing (18) to 1c, 4c, 7c, 10c, 13c, 16c, 19c, or 22c, depending on the channel selected.

b/ Connect the left forward bushing (18) to 2c, 5c, 8c, 11c, 14c, 17c, 20c, or 23c, depending on the channel selected.

c/ Connect the right backward bushing (19) to 1a, 4a, 7a, 10a, 13a, 16a, 19a, or 22a, depending on the channel selected.

d/ Connect the left backward bushing (19) to 2a, 5a, 8a, 11a, 14a, 17a, 20a, or 23a, depending on the channel selected.

In the case of two-wire transmission, the forward and backward inputs can be connected for each input.

NEVER connect signal wires to (18) and (19) when the Scanner is used.

ELECTRONIC MEASURING INSTRUMENTS

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